VOLUME LIX JANUARY, 1903 No. 3

AMERICAN JOURNAL OF INSANITY

THE INSANE IN BRAZIL.

BY W. H. KIDDER, M. D.,
Oswego, New York.

The subject of "The Insane in Foreign Lands" has been so ably treated by Mr. Letchworth and in articles and monographs from other pens that I feel no little trepidation in entering upon its discussion. Especially am I conscious of the fact that nearly all that has been written upon this topic has concerned the insane of countries whose civilizations and climates have in no slight measure resembled our own. Thus may I well hesitate in approaching a branch of the subject which is to deal with the insane of a country whose climate is radically different and in which the customs of life are so unlike ours as to make comparisons difficult and uncertain.

To intelligently treat of the insane in Brazil we must first give some little attention to Brazilian conditions and life. In view of the fact that the amount of literature descriptive of this great Republic of the South is quite limited and the knowledge of it possessed by the average North American often meagre and inaccurate, there seems the more reason for referring to conditions of normal life before taking up specifically the insane and their care.

Having an area of over three million square miles and a population, according to the census of 1900, of 24,218,500, the United States of Brazil contains vast regions that are almost uninhabited and smaller areas where the population is fairly dense. The country is divided into twenty states and a federal district, the

latter corresponding to the District of Columbia of the United States of North America. The great industries are agriculture and mining, but so bounteous is the productivity of the tropic soil that, although this is in no sense a manufacturing country, there is a marked trend toward the development of urban populations. Thus it happens that in the cities there is a large poor population with comparatively little work to do and an abundance of idle time. Easily providing themselves with the absolute necessities of life, these people suffer poverty, not by the force of unavoidable circumstances, as is often to some extent the case with the poor of our large cities of the North, but instead from a lack of the knowledge, ambition and energy necessary to any effort to take advantage of the many offers of abundance made by one of the richest areas of the earth. Among this class the crowding, especially in the cities of Rio de Janeiro and Bahia, is very noticeable. True, the buildings are seldom high, being mostly not of more than two or three stories. Remembering that in these cities roofs are needed not so much to protect from cold as from rain and transgressors, human and other, we can account for the crowding only as an effort of helpless ignorance to avoid segregation. In some places the conditions remind us of the story of the man, who, in the old days when the poor quarters of London were the scenes of such crowding, said that "The people live three families in a room and often the family occupying the middle of the floor adds to its income by taking in a lodger."

The staple article of food is farinha, a flour made from the root of the mandioca. A species of black beans is also extensively used. Fruits of various kinds are cheap and obtainable even by the very poor. With the lower classes meat is a less common article of diet and is more often in the form of "carne secca," a native dried beef. The lavishness of Nature is so remarkable and the climate so mild that it has often been said that in Brazil no begger ever goes hungry or wants for raiment. While on the whole the poor may be considered as temperate in the use of alcoholic liquors, they consume considerable quantities of a native spirit called *cachaca*, distilled from sugar cane. It possesses strongly inebriating properties. Beer is not so much used by the poorer people because of its cost. The native

beers are of excellent quality and are made under government protection.

This lower stratum of the population is largely negro, pure or tainted. There are Brazilians descended from the original Portuguese settlers, a considerable number of Italians, Indians, and a conglomeration of the offscourings of all countries, as is to be found in large centres of population the world over. Living as these people do in crowded quarters in cities where the moral virtues might be more highly esteemed, with few educational advantages and under the influences of a climate which can well be called sensuous, we can readily believe that their moral state is far from the ideal. Also, we must bear in mind that only fourteen years have passed since a great population of blacks was thrown upon its own resources and its own sense of moral self-restraint, slavery having been abolished in 1888.

The more prosperous inhabitants of the Brazilian cities live in accordance with the dictates of a highly developed modern civilization. In the use of alcoholic beverages they are abstemious, and in this respect they have been called the most temperate of the civilized peoples of the world. The Brazilian is an inveterate smoker of cigarettes, and in the consumption of coffee practices the extreme of overindulgence. I have heard the statement, and myself fully believe it, that in Brazil the overindulgence in coffee is a source of greater injury to the people than is the use of alcoholic beverages in the United States. With us alcoholism in some degree acts as an eliminator of the weak, a weeder-out of the unfit; in Brazil coffee, used by all, is an agent for the universal sapping of nerve stability. The tendency to sensuality is notable, and as a result syphilis is lamentably common. Large numbers of people exhibit nervous tremors, and premature senility is often noted. Here life seeks easy channels. It is the "Land of *amanha*," but to compensate for the comparative lack of strenuous labor are these forces which are a greater drain upon the nervous energies.

Although most of Brazil lies within the Torrid Zone, the different parts offer some variations in climatic conditions. The Amazon Valley and considerable portions of the Atlantic coast are hot and humid and present ideal breeding grounds for miasmatic disease. Along much of the coast malaria is common

and its sequelæ are seen in neurotic troubles, which undoubtedly constitute no slight force in the production of mental decline. Parts of the coast present highly salubrious conditions. Much of the interior lies at an elevation which insures to it a climate of exceptional healthfulness. However, the always present green and the sensuous wealth of vegetation become monotonous. It is common to hear foreigners resident in Brazil lament over the entire absence of stimulating change in season. In Rio de Janeiro the variations of temperature over a period of thirty-five years lay between the extremes of 37.5 C. (99.5 F.) and 10.2 C. (50.3 F), with a mean of 23.5 C. (74.3 F.).

It is impossible to formulate any statistics regarding the number of insane persons in Brazil. It is easy to see, however, that there are various forces at work which tend to undermine the mental stability of the naturally weak. While life is less strenuous than in our northern country, we are, I think, justified in concluding that the percentage of the insane is at least as great as in the population of the United States. The policy of the various state governments is to assume responsibility for the care of their insane, either by the establishment of state institutions owned and controlled directly by the state, as in the State of São Paulo, or by forming a community of interests with the managements of private charities, usually some Catholic benevolent order, as in the States of Rio de Janeiro and Bahia. The public insane of the Federal District, the city of Rio de Janeiro, are cared for by the Federal Government in the National Hospital for the Insane and in the Colonies. In the Federal District, where this subject has for many years received enlightened attention, the numbers of the insane in the National Hospital and the Colonies constitutes about one for every 800 of population, barely half the percentage to be found in the public institutions of New York State. In the State of Bahia, where the care of the insane is still in primitive stages of development, the number incarcerated in the public asylum forms not quite one for every fifteen thousand of the State's population. It is manifest that even in the Federal District there is a great discrepancy between the number of the insane maintained in the public hospital and the total number within the district. This difference is even greater than it would at first seem to be, as some of the inmates

of the National Hospital were received from other commonwealths. The worst of the alienated criminals we find in the prisons, while in the various institutions and hospitals designed for the indigent and helpless poor we find considerable numbers of persons whose mental state shades from pure insanity down to that of the dotard. Then, about the streets of the cities are to be met many cases of harmless mental derangement and dementia. Before criticising the policy which permits these people to range at large, we must think of the character of the climate and the ease with which a vegetative existence is there maintained, and must remember that Brazil represents a Latin and not an Anglo-Saxon civilization. In a State like Bahia, where the distances between towns are great and the means of transportation limited often to journeying by mule back, it would be impossible to have any considerable percentage of the insane gathered into a single state institution.

The National Hospital for the Insane is under the control of the Minister of Justice and Internal Affairs. It is located in the city of Rio de Janeiro, near the entrance to the great harbor and looking out upon the beautiful little bay of Botafogo. Before it passes in long procession the shipping of all nations, while around rise the verdure clad peaks which make Rio de Janeiro one of the most wonderfully picturesque cities of the world. The architecture of the hospital is not unworthy of such inspiring environment. The main building is a granite-faced structure of noble appearance, standing only a little back from the street. The entrance is imposing and leads one into a spacious and lofty marble-tiled hall. From this open the various administrative offices and also rooms devoted to photography, electrotherapy, a museum, to pathological anatomy and to the school for nurses. The hospital is planned not only to provide for the care and treatment of the insane, but also to further the study of psychiatry and to give opportunity for clinical instruction to the students of the Medical College of Rio de Janeiro. The superintendent of the hospital, Dr. João Carlos Teixeira Brandao, occupies the chair of psychiatry in the college and other members of the hospital staff belong to the teaching force of the school. The equipment of the hospital for investigation and clinical work is, accordingly, very complete and probably equals that of any similar institution in Europe or North America.

The main building is of two stories, and like most institutions for the insane is divided into symmetrical halves or sides, one for each sex. The floors are mostly of native hard woods and are highly polished. In the offices particularly their condition is such as to excite the keenest admiration. Tiled floors are found in the water-sections and wherever needful. The day-rooms are of moderate size as opposed to large congregate-rooms. The amount of day-room space is, I should say, considerably less per capita of population than is usual in institutions in the United States. This, however, only represents the adaptation of architectural needs to climatic conditions, there being no season of the year when the patients cannot spend most of the day out of doors. Throughout the hospital there is a large percentage of single rooms, though dormitories are used to some extent. The single rooms are remarkably large, and each is provided with a bed and some with other furniture as well. The dormitories are roomy and not unduly crowded. The bedsteads throughout are of iron but of unattractive pattern. The outfit of bedding is much less elaborate than in our institutions of the North, but is abmirably adapted to the needs of dwellers in that climate where a hair mattress is an abomination, a source of discomfort and wakefulness. Grass is used instead of hair.

The most unpleasant feature of the hospital is to be found in the dining-rooms. The tables are without coverings and have but a limited supply, or rather, variety of furnishings. The patients seat themselves upon long benches, after the fashion once practiced in some of the old county institutions of the United States. However, a commendable degree of cleanliness prevails, and we must remember that probably the average poor patient in Brazil was never, prior to his confinement, accustomed to a table spread and seldom even possessed what we would consider a comfortable chair. Three meals are served daily. It is interesting to note that coffee is served to the employees in the morning between 5.30 and 6.00, the public patients having breakfast at 7.00, and the private patients, pensioners of the 1st class, and employees, breakfasting between 8.00 and 8.30. The food is as good if not better than the private poor of the city have in their homes. The store-room, where the supplies of provisions are kept, is a marvel of neatness, system and beauty.

The kitchens are tile-floored and cleanly, but, to the mind of a Northerner, poorly equipped. However, there are utensils for use in all the processes of cookery necessary to the customs of the country.

The bath-rooms, somewhat separated from the wards, are spacious and of elaborate equipment. The floors are of tile, of excellent workmanship, and the plumbing is modern and on the "open" plan. The apparatus is all good and kept in a condition of perfect cleanliness. There is, however, little display of marble or of nickeled trimmings. The expense of the equipment of one of these rooms must have considerably exceeded that usually incurred in the corresponding department of one of our better hospitals, but this expense results rather from the greater elaboration of the apparatus than from display and ornamentation. The rooms contain several tubs, a small plunge, sprays, needle sprays, douches, steam cabinets, in fact, nearly everything that could prove useful either in maintaining bodily cleanliness or for hydrotherapeutic treatment. Special tubs are provided for the continuous bath for excited cases. These have ingenious covers of light canvas, which hold the patient's head out of water and the body underneath. Dr. Freitas said that the continuous bath had been used to a considerable extent in the hospital, but that they had found its great prolongation offering no special advantages, a continuance beyond six hours seeming unproductive of good results. Cleansing baths are given to all patients three times per week. Climate considered, this is none too frequent.

The laundry is well equipped, roomy and with excellent ventilation. The methods used mostly correspond to the customs of a country where steam laundries have not yet gained a foothold. There are, however, some centrifugal wringers and a well arranged steam drying-room. This latter arrangement seemed to be looked upon as quite a novelty. Patients do most of the laundry work. Other patients are occupied in making clothing, shoes, brooms and many of the things needful for use in the institution, and in caring for the wards and grounds. The systematic employment of patients is practiced to a commendable degree, the assignment to work being under the direction of a physician.

To the rear of this main building are the fine vegetable gardens of the institution, bisected by a well kept avenue, which is bordered by trees of luxurious growth and which leads to the reception pavilion. This is a brick building of recent construction and contains elaborately appointed offices and examination-rooms and one-story wards for about twenty patients of each sex. Here the equipment for the clinical study of psychiatry is very complete and the means for treatment elaborate and modern in development. The electrotherapeutic and hydrotherapeutic equipments are particularly complete, the former being the most elaborate I have ever seen in a hospital for the insane.

Patients are admitted to the hospital on an order of the Minister of the Interior, the Chief of Police of Rio de Janeiro or the Prefect of the Federal District, given on the certificate of an examining physician. They can also be received upon the petition of a private person who is a near relative, guardian or head of a religious or beneficent order, properly attested and accompanied by the certificate of two examining physicians. The medical examinations must be made within fifteen days of the date of the petition. A guarantee covering necessary expenses must also accompany the petition.

Patients are usually brought to the hospital in a closed carriage or hack. The newcomer enters a small office in the reception pavilion, where a physician examines his credentials of admission and holds brief converse with him. The patient is then sent to the ward, bathed and prepared for a thorough examination. This is made by an interne, who records his observations on suitable blanks. I was particularly struck by the fullness of this examination and the care with which the anthropometrical measurements are made. Those of the cranium are supplemented by life-size diagrams of the circumference and profile of the skull. Within twenty-four hours after admission the patient is again examined, this time by the physician in charge of that division of the hospital, who corrects and adds to the notes of the interne. A photograph is also taken, but usually only a full face view.

For fifteen days the patient is carefully watched and daily notes of a minute character are entered in the case book. At the end of this time the physician in charge of the patient

presents to the director (superintendent) of the hospital a report of his observations. If the case is not a suitable one for treatment in the hospital, he is then at once discharged. Otherwise he is kept in the reception pavilion or transferred to one of the wards of the main hospital building, as may seem to be indicated by his condition. Chronic cases capable of doing farm work are from time to time transferred to the Agricultural Colonies on Governor's Island in the Bay of Rio de Janeiro. Here the products of their labors go toward their own support and to help supply the inmates of the National Hospital. Any excess of production over the needs of the colonies and hospital is sold in the city. In some years this has amounted to quite an item. The colonies are not actually subordinate to the National Hospital, having a distinct superintendent. The hospital affords accommodation for about eight hundred patients, and the colonies for about two hundred and fifty.

Upon recovery patients are released from custody without restrictions, or are given parole in case the recovery seem of a doubtful nature. Other patients of harmless character and those whose conditions would, without undue risk to the public, be bettered by the change, are released on parole or "license." These licenses are for either a fixed or an indefinite time, as the individual case may seem to merit, and return to the hospital within the period for which the license is issued is without formality.

As regards maintenance, there is a rather elaborate classification of patients. We may roughly speak of the two main divisions as private and public. The latter are either from some department of the public service, as the army and navy, or are being maintained by individual states of the Republic or by the Federal District. These patients occupy beds in the dormitories and are subject to certain restrictions in diet. The private patients or pensioners are divided into four classes, those of the first class paying fifteen milreis, now about the equivalent of three and a half dollars, daily, and occupying a furnished room with all "possible comforts" and each with the exclusive use of one servant. Pensioners of the second class pay seven and a half milreis daily and have furnished rooms with only one bed each. Those of the third class are placed two in a room, each

being provided with a bed, while patients of the fourth class occupy dormitories containing from eight to sixteen beds. The two last named classes pay four and a half and three milreis daily, respectively. We must not be surprised at a classification of this sort in a country which had an emperor only thirteen years ago.

A training school for nurses has been maintained in the National Hospital, but the great difficulty of obtaining attendants adapted to a life work of this nature has caused the authorities to abandon, for the present, the conduct of the school. Considerable space is given to the consideration of this matter in a recent report of the department. During my visit the attendants showed a kindly and attentive bearing towards the patients. Among the latter I saw only one black eye and that in a case of acute alcoholism admitted on the previous day. The patients spend most of the day out of doors where they have opportunity to exercise. I was informed that the use of mechanical restraint was not practiced.

To illustrate primitive conditions in the development of the care of the insane we will briefly consider the Asylo de São Joao de Deus in the city of São Salvador da Bahia. This institution is owned by the State of Bahia. Founded in 1874, it was at once given over to the management of the House of Mercy, a large Roman Catholic charitable institution, the State to pay two milreis (at par $1.08 but at present rate of exchange about 48 cents) per day for each of one hundred patients, other receipts and expenses to be entirely on account of the House of Mercy. The asylum was built to accommodate sixty patients. At present, April, 1902, it contains one hundred and eighty-three. Lack of funds in the State treasury prevents change and enlargement, and though the House of Mercy is constantly remonstrating and refusing to admit patients, this being the only asylum in the State, public or private, it is forced to open its doors to the worst cases. The buildings, four in number, are well located, but for the most part in a bad state of repair and in an unsanitary condition. There are single rooms and dormitories. In the latter the beds are in the proportion of one to about five patients. The floors are of tile. The single rooms occupied by the violent patients resemble cells. They have cement floors

and walls of plastered brick. At one end there is fixed into the wall a sort of shelf, which during the day serves as a seat and at night is used as a bed for two patients. In front of each of these rooms is a stream of the hardened residue of urine.

The food provided for the inmates is of good quality and the kitchens are clean. The grounds are well cared for and vegetables and fruit in abundance are produced. The patients are given some employment, but are not otherwise provided with diversion.

The authorities of the House of Mercy and the members of the medical profession of Bahia are fully aware of the backward state of the public care of the insane of Bahia, and they have repeatedly protested against present conditions and endeavored to secure legislative relief. In March, 1895, the Medical and Surgical Society of Bahia appointed a committee to investigate conditions in the public asylum, and in July of the same year this committee made a careful and rather scathing report, which was brought to the notice of the Governor. This report included a set of recommendations, which, if carried out, would have secured to Bahia one of the most up-to-date hospitals for the insane to be found anywhere. However, the necessary appropriations have not yet been forthcoming.

Of the states of Brazil, São Paulo stands foremost in wealth and in the spirit of progress. Lying just within the South Temperate Zone and at a considerable elevation, its climatic conditions are unsurpassed. Even more than in the industrial spirit has this state shown advancement in the development of its provision for the public care of the insane, until now it can boast of one of the best planned and equipped institutions in the world. Entering upon a series of investigations in 1892, the authorities finally adopted, with some modifications, the plans proposed by the International Congress which assembled in Paris in 1889. Work upon the buildings was commenced in 1895, and in May, 1898, one of the colony buildings was opened. The institution is located at Juquery, at a distance of rather less than an hour by rail from the city of São Paulo. It comprises a main hospital plant and a set of agricultural colonies. The development of the hospital and colonies centres about two main purposes—the provision of means for the efficient scientific treat-

ment of the acute insane, and the development of pleasant and productive employment among the chronic insane.[1]

In the Federal Capital there are several private institutions for the insane. Of these the largest is that of Dr. Carlos Eiras, the "Casa de Saude," House of Health. It is roomy and well equipped, and though situated in the heart of one of the fine residence centres of Rio de Janeiro, it has ample grounds wherein the patients can exercise. Although the buildings are the gradual development of constantly increasing needs, they are quite well planned and are well equipped. In treatment considerable attention is given to hydrotherapeutic measures. The head of the establishment, Dr. Carlos Eiras, is a man of exceptional breadth of mind and of wide experience in the care of the insane, having been associated with Régis before the latter left Paris.

We have touched upon the question of the care of the insane in only a small portion of the Republic of Brazil. However, instances illustrating the extremes of efficiency have been considered. Some of the other states, notably Pernambuco, Rio de Janeiro and Rio Grande do Sul, have institutions of some merit, all, however, only indirectly under state control. Away from the large centres of population there live great numbers of people, scattered over vast and comparatively inaccessible areas. The removal of an insane person from this portion of the population to any central institution could only be undertaken at great expense and in cases in which the financial resources of the patient's family were of generous proportions. Under such conditions expediency must determine, in no slight measure, the fate of the unfortunates.

It seems not wise to attempt to make statistical comparisons between the public institutions of Brazil and those of the United States. Even were statistical tables available, the results would be misleading. Accuracy could only be approached after a long and exhaustive study of normal psychic, sociological, political

[1] For a detailed account of this institution, consult the "Archivos De Criminologia Medicina Legal Y Psiquiatria," of Buenos Aires, Ano 1, No. 3, March, 1902—"Asilo-Colonia de Alienados de 'Juquery' Su Organizacion Y Ventajas." Por el Dr. Franco Da Rocha (São Paulo, Brazil), Profesor de Psiquiatria y Director del Asilo.

and natural conditions. As one of the more simple instances of such difficulties it may be noted that in the National Hospital of the Federal Capital the death-rate is large. In the United States such a rate would be considered appalling and would be taken as indicative of gross inefficiency and neglect on the part of the physicians. In Rio de Janeiro it points to defects for which the hospital is responsible in only a slight measure. One of the chief faults is extreme tardiness in commitment, so that a considerable percentage of the patients are in a condition bordering upon collapse when taken to the hospital, and not a few die within the first twenty-four hours. The authorities have given much attention to this defect, but its elimination depends more upon the gradual education of the people than upon direct legislative effort. There are also among the insane many fatalities resulting from grave somatic disease incident to the tropic climate.

When we look upon such splendid institutions as the National Hospital and note the completeness of its provision for the scientific treatment of the insane, and even more, when we discover what wonderful attention to detail has entered into the organization of its medical service, we cannot but express admiration and, perhaps, wonder if here is not a country which leads the United States in the development of some of its institutions for that class. The hospital at Juquery would still further excite such thought. Then, too, in Brazilian medical literature and in various public reports relating to the hospitals are to be found expressions of the most advanced ideas regarding the insane and their care. During recent years the Federal Government has beer considering the establishment of a hospital for the criminal insane. Dr. Mello Reis was made a commissioner to investigate the subject in Europe, and his report includes descriptions of the principal institutions for the insane and for epileptics and alcoholics on the Continent of Europe. In spite of all this wonderful attention which has been given to the subject it would seem that the inmate of one of the better institutions of the United States leads a pleasanter life than his Brazilian brother, and I feel sure that his chances for recovery are better. It must be recognized, however, that in Brazil development of general commercial and educational interests

has not been relatively so great as the advancement in the consideration of the care of the insane. This may be explained by the fact that the physicians of the country keep in close touch with medical progress in Europe, particularly in France, and that they themselves constitute a body which represents, perhaps, the most highly developed educational advancement to be found in Brazil.

From a large number of tables coming from various hospitals, I append herewith only three, which are self-explanatory.

In closing I wish to express my appreciation of the assistance afforded me in my efforts to obtain information about the insane in Brazil, by Sr. Carlos Amerigo dos Santos and Sr. Ernesto Senna of Rio de Janeiro, and by Dr. Furniss, American Consul at Bahia. But particularly am I indebted to Mr. George Chamberlain, Secretary to the Consulate in Bahia, who obtained for me much information relative to the care of the insane in Bahia and who made a careful inspection of the hospital, an institution to which access is not readily gained.

FEDERAL DISTRICT OF BRAZIL.—DEPARTMENT FOR THE CARE OF THE PUBLIC INSANE.—MOVEMENT OF PATIENTS DURING THE YEAR 1900.

	National Hospital.				Colonies for the Insane.			
	Men.	Women.	Total.	Total No. under treatment.	Men.	Women.	Total.	Total No. under treatment.
Remaining January 1, 1900	403	355	758	..	246	..	246	..
Admitted during the year	351	264	615	..	109	..	109	355
Returned from parole	5	9	14	..	..	..	..	..
Returned from the Colonies	54	..	..	..	..	..	..	..
Returned after elopement	1	..	1	1442	..	..	..	..
Discharged recovered	139	124	263	..	11	..	11	..
Released on parole	32	39	71	..	1	..	1	..
Escaped	2	2	4	..	1	..	1	..
Transferred to the Colonies	109	..	109	..	..	..	..	..
Removed to the Isolation Hospital	1	..	1	..	..	..	..	..
Transferred to the National Hospital	..	..	..	..	54	..	54	..
Died	112	116	228	..	52	..	52	..
Under treatment Dec. 31, 1900	420	346	766	1442	236	..	236	355

TABLE SHOWING THE SALARIES PAID IN THE DEPARTMENT FOR THE CARE OF THE PUBLIC INSANE OF THE FEDERAL DISTRICT OF BRAZIL.

HOSPICIO NACIONAL.

	Annual salary.
1 Director (Superintendent)	9:000$000
1 Medico do pavilhao	3:000$000
4 Medicos a 3:000$000	12:000$000
1 Chefe do gabinete electrotherapico	2:400$000
1 Pharmaceutico	2:400$000
1 Almoxarife (Steward)	4:800$000
2 Escripturarios a 3:600$000 (Book-keepers)	7:200$000
1 Amanuense	2:400$000
1 Continuo (Messenger)	1:600$000
1 Porteiro	1:200$000
Total	46:000$000

COLONIES.

	Annual salary.
1 Director	6:000$000
1 Medico	4:800$000
1 Pharmaceutico	2:400$000
1 Almoxarife	3:600$000
1 Escripturario	2:400$000
Total	19:200$000

NOTE.—1$000 (one milreis) equals about 25 cents, varying with the rate of exchange 1:000$000 (one conto de reis) equals about $250.00.

TABLE OF PROVISIONS AND EXTRAS CONSTITUTING THE DIET IN THE NATIONAL HOSPITAL.

Provisions whose quantities are determined.		Extras whose quantities are designated by the physicians.
Beef, roast or steak	300 gms.	Eggs.
Pork	200 "	Milk.
Mutton	250 "	Beer.
Fowl for broth	6 "	Wine.
Fowl for roasting	1/4 "	Limes.
Rice	60 "	Oranges.
Vermicelli	30 "	Grapes.
Potatoes, Irish	60 "	Bananas.
Fresh fish	150 "	
Jelly	30 "	
Fresh bread	120 "	
Biscuit	100 "	
Coffee	30 "	
"Matte"	15 "	
Tea	8 "	
Chocolate	40 "	
Marmalade or guiava jelly	30 "	
Cheese	40 "	
Toasted bread	100 "	
Butter	10 "	
Tapioca	60 "	
Meal	80 "	

NOTE.—Very important articles of diet not included in this table are "farinha de mandioca," beans, peas, sweet potatoes, pearled barley and codfish. Many other supplies enter into the diet from time to time. A goodly variety of condiments is provided.

A CONTRIBUTION TO THE CHEMISTRY OF NERVE DEGENERATION IN GENERAL PARALYSIS AND OTHER MENTAL DISORDERS.

By ISADOR H. CORIAT, M.D.,
Worcester Insane Hospital.

While morphological studies of the central nervous system have created an immense literature since the advent of the neuron concept, it is only within the last few years that the chemical changes involved in cell and fibre degeneration have been the subject of attention. With the advance of neurological technique, it was observed that different morbid changes reacted differently to various stains and this was particularly well illustrated in those cases of myelin-sheath decay that reacted to osmic acid in such a manner as to precipitate the metallic osmium, the microscopic picture of such a reaction being the appearance of a large number of black droplets, arranged in a straight line along the course of the original myelin sheath. This reaction had proven the substance in question to be fat. The chemistry of nerve degeneration, so far as a present knowledge will permit us to state, is limited to katabolic processes in the lecithin, which is the main constituent of the myelin sheath and to decomposition in the axis cylinder. Of the latter we know but little, but certain facts are well established for the former process. The complex phosphorized fat, lecithin, splits up on hydrolysis into glycerophosphoric acid, stearic acid and cholin. The stearic acid unites with the glycerol radicles to form neutral fat and it is on this latter that the Marchi reaction depends. This takes place according to the following formula:

$$\underset{\text{(lecithin)}}{C_{44}H_{90}NPO_9} + \underset{\text{(water)}}{3H_2O} = \underset{\text{(stearic acid)}}{2C_{18}H_{36}O_2} + \underset{\text{(glycerophosphoric acid)}}{C_3H_9PO_6} + \underset{\text{(cholin)}}{C_5H_{15}NO_2}.$$

While the synthetized neutral fat collects in droplets along the course of the myelin sheath, the cholin is eliminated in the cerebrospinal fluid and the blood, while the glycerophosphoric acid appears in the urine, serving to augment its organic phosphorus.

Steapsin also splits lecithin into glycerophosphoric acid, free fatty acids and cholin. Hasebrock[1] investigated the action of putrefactive bacteria on lecithin, and found that these same products were formed, but only when the action of atmospheric oxygen was completely shut off. By the continuous action of bacteria, the cholin furthermore splits up into CO_2, CH_4 and NH_3. Under these circumstances, poisonous cholin derivatives are not produced, but by the addition of oxygen cholin is readily transformed into the poisonous neurin and muscarin. As the decomposition products of lecithin pass most readily into the cerebrospinal fluid, it is to this that we must turn our chief attention. Even in normal individuals, the amount of the fluid, if we take as a standard that obtained by lumbar puncture, is subject to great variations. According to Nya,[2] the fluid is most abundant during the first years of life and there is an increase under pathological conditions in certain infectious diseases and always in hydrocephalus and general paralysis. This latter has also been noted by other observers. The normal fluid is usually colorless or light yellow, the pigment being that found in blood serum-lutein. In subdural hemorrhage, from whatever cause, the color is red, while in jaundice it is greenish-yellow and purulent in suppurative meningitis. Abadie[3] states that after the ingestion or the subcutaneous injection of potassium iodide or methylene-blue, these substances may appear in the fluid. The reaction of the central nervous system is alkaline during life, but after death or on long continued activity, the reaction becomes acid. This is due to the lactic acid of fermentation (optically inactive ethylidene lactic acid) and not to sarcolactic acid. The cerebrospinal fluid is also alkaline during life, but readily becomes acid after death. The effect of long continued activity of the nervous system and muscles upon the reaction of the fluid, such as occurs in convulsive seizures, we shall return to later. Turner,[4] using Uffelmann's reaction, showed the acidity of the cerebrospinal fluid to be due to lactic acid, and that it appeared

to increase with the length of the interval which had elapsed between the time of death and the time of testing. Panzer,[5] in the cerebrospinal fluid from two hydrocephalic fœtuses, found a feebly alkaline reaction. We are thus able to see what an intimate connection exists between the reaction of the brain tissue on the one hand and the cerebrospinal fluid on the other, if indeed the latter be not the direct result of the former. The specific gravity is usually low, varying from 1007 to 1010. Panzer, in his analyses of fluid from two hydrocephalic fœtuses, found it to be respectively 1008.62 and 1009.17. Of the nitrogenous glucocides but little is known, especially in regard to the relation of these bodies with the reducing substance in the cerebrospinal fluid. This reducing body, which is present in small quantities, has been especially investigated by Halliburton. After removal of the proteid by the usual methods, there is found in the fluid a substance which reduces copper salts but not bismuth, does not ferment or rotate polarized light and yields no osazon with phenylhydrazin. This substance is probably pyrocatechin. Both Panzer[6] and Cavazzini[7] found glucose in cases of hydrocephalus. Nauratzski[8] showed that, in the cerebrospinal fluid of calves, there was a substance which reduced copper in alkaline solution and had all the characteristics of dextrose, but that this reducing power gradually disappeared after death and finally became nil.

Schaefer[9] records the case of a patient suffering from hereditary dementia who in later years developed diabetes. The urine continued 8 per cent of sugar and the patient died in diabetic coma. After death 77 cc. of cerebrospinal fluid were removed, which was light yellow, with a specific gravity of 1010, and contained one per mille of albumin. After removal of the albumin, Nylander's test was positive and by titrating with Fehling's solution, he found .32 to .35 per cent sugar. That this reducing body was undoubtedly sugar, although no record is given of the fermentation and phenylhydrazin tests, is shown by the fact that it reduced bismuth, a property not possessed by pyrocatechin. In normal cerebrospinal fluid the total proteid (globulin, nucleoproteid, protalbumose) is very low. According to Quincke, it is from .2 to .5 per mille; according to Ricker, .5 to 1 per mille; according to Gumprecht, only .25 per mille. As a

rule, however, it does not exceed one part per thousand. The amount is increased in hydrocephalus, general paralysis, in stagnation from brain tumors and in hydrocephalus. Both Schaefer and Halliburton found a constant increase of proteid in general paralysis, the former giving an average of 1.23 per mille, the latter 2.39 per mille. Babcock, in 12 cases of general paralysis, also found an increase; and Nauratzski, in six cases of the same disease, found the albumin weight varying from .468 to .696 per mille. Panzer, in his two cases of hydrocephalus, gives the albumin figures as .599 and 0.99 respectively, and Abadie also found an increase in acute meningitis. Abnormally albumose and peptone have been found in meningocele.

The toxicity of the cerebrospinal fluid has been shown by Halliburton to be increased in general paralysis, the effect being due, as will be afterwards shown, to cholin and other products of nerve katabolism. Bellisari has also shown that the cerebrospinal fluid of individuals suffering from general paralysis is more toxic than normal, and that this toxicity is at its maximum after epileptiform seizures. Pellagrini [10] determined the toxicity of the fluid in epileptics. The fluid was obtained during life by lumbar puncture and the amounts varied between 10 and 15 cc. He investigated six cases of epilepsy and arrived at the following conclusions. He found that the cerebrospinal fluid of epileptics is markedly toxic, and that, on being injected into guinea-pigs, there always resulted grave and intense convulsive phenomena, so much so, that in some cases a status epilepticus was produced. The fluid extracted immediately after a convulsion was more toxic and convulsive than that obtained at periods far removed from the paroxysm, and anti-epileptic drugs exercised no influence upon the toxic power. Cultures were sterile. That this toxicity is due to the potassium salts can be readily eliminated, because the quantity which exists in the fluid is so small and would be entirely out of proportion to the intensity of the symptoms. If the cerebrospinal fluid plays the part of the lymph of the central nervous system, and if one of the decomposition products of lecithin, glycerophosphoric acid, be eliminated in the urine, and the other, stearic acid, combine with the glycerol radicles to form neutral fat which replaces the myelin sheath, the third decomposition product, cholin, must be the one on which

the toxicity of the cerebrospinal fluid depends. That this is a fact and not a mere hypothesis, will certainly stand rigid inquiry and critical analysis. Cholin is a substance which is widely distributed in the animal and vegetable kingdom, but is best known as an hydrolysis product of lecithin. It differs from neurin in being less toxic, in producing no precipitate with tannic acid, and in its physiological action. It produces a fall in arterial pressure, while neurin creates a fall, followed by a marked rise and a subsequent fall to a normal level, while with small doses the preliminary fall may be absent. Neurin is intensely toxic to the nerve trunks and produces a marked effect on the respiration, first greatly increasing it, then lessening it, and finally causing it to cease altogether. Cholin has no action either on the nerve trunks or on respiration. It is absent in normal cerebrospinal fluid, but is present in the fluid of those patients who have died from some brain disease in which there is great disintegration of the cerebral substance and it must be looked upon, as has previously been stated, as a decomposition product of lecithin. It is found in general paralysis, combined sclerosis, disseminated sclerosis, alcoholic neuritis and beriberi. In those conditions in which it is present in the cerebrospinal fluid, the blood may also contain it, although it is absent from the urine, this doubtless being due to the fact that it is decomposed before being eliminated by the kidneys. Halliburton,[11] in a series of eighteen cats, in which both sciatic nerves were divided, found that cholin appeared in the blood, the amounts being parallel with the extent of the nerve degeneration as measured by the Marchi reaction.

In every one of the cases of general paralysis, Halliburton[12] found in the cerebrospinal fluid, removed both during life and after death, a large excess of nucleo-proteid, and a substance which was identified, both chemically and physiologically, as cholin. In cases in which the blood was examined, cholin was also found. This he explained on the basis of the myelin decay in general paralysis, with a consequent diminution in the brain weight, and he found the evidences of this myelin degeneration in the black degenerated fibres and in the black particles in the leucocytes and endothelial cells in the perivascular lymph spaces, as revealed by the Marchi reaction. That the epileptiform seiz-

ures of general paralysis are not the result but the cause of the appearance of cholin in the cerebrospinal fluid and in the blood, finds its explanation in the non-convulsive action of cholin when injected into animals. The toxæmic theory of general paralysis, which would regard the condition as the result of auto-intoxication by cholin and other products of nerve degeneration, is yet to be proven. In a recent contribution on the toxic action of the decomposition products of lecithin, Wood [13] gives a summary of the action of cholin and presents the results of a series of experiments upon neurin, which he finds is similar in physiological action to cholin with certain differences. He has done but little more than repeat the work of Halliburton.

In the field of phosphoric acid metabolism but little is known. The amount of glycerophosphoric acid eliminated in normal urine is about 15 milligrammes per liter, but so far no thoroughly systematic investigation has been made of its increase or diminution under pathological conditions. This is due in a measure in part to the extremely complicated method for the accurate quantitative determination of glycerophosphoric acid, and in part to the fact that a substance eliminated normally in so small an amount would either be so slightly increased or so slowly eliminated that painful accuracy would be necessary. Folin and Shaffer,[14] in a case of manic-depressive insanity, exhibiting a state of manic-exaltation alternating with a lucid interval from day to day, have shown that on the active days the phosphoric acid was in excess of that of the normal periods. This they explain on the basis that on every second day the system is unable to assimilate a part of the ingested phosphates, and more phosphoric acid is therefore eliminated on this (the manic) day. On the contrary, in the quiet condition, a less amount is eliminated because on this day the body is repairing the loss of the previous one. Laborde [15] fed tuberculous guinea-pigs with lecithin and found a decrease in the excretion of phosphorus.

Noll [16] divided the sciatic nerve of a dog on one side and fifteen days after the operation the animal was killed. The phosphorus in the degenerated nerve was 67.4 per cent of that on the healthy side, but the alcoholic extract of the nerve was 77 per cent of that on the healthy side. Mott and Barrett [17] made complete analyses of two cords from cases of hemiplegia and report the

following findings on the degenerated side of the cord: (1) A breaking up of the phosphorized fat occurs. (2) The amount of lecithin present is diminished. (3) The amount of fat is present in excess. (4) The amount of extractives soluble in ether is increased. (5) The proteid residue diminishes in amount with the increase of the extractives in ether. (6) The phosphorus in the residue diminishes at a still greater rate than the residue itself. (7) The per cent of phosphorus in the one-half of the cord is, as a rule, diminished. (8) The ether extract has an appearance of butter instead of being crystalline. Barrett,[18] also in the brains from five cases of general paralysis, found the phosphorus to be decreased, and the water increased, the degree being parallel with the amount of fibre degeneration. In two cases of mania with moderate fibre degeneration, the water and phosphorus were about normal. The largest amounts of water and the smallest percentage of phosphorus were found in a case of alcoholic dementia. In the cords of seven cases of general paralysis the amounts of water were also increased and the phosphorus was diminished, the largest increase of one and decrease of the other being parallel with the amount of sclerosis and degeneration of the pyramidal tracts. Halliburton [19] divided both sciatic nerves in a series of eighteen cats, and the animals were subsequently killed at periods varying from 1 to 106 days. The nerves were practically normal so long as they remained irritable, that is, up to about three days after the operation. They then showed a progressive increase in the percentage of water and a progressive decrease in the amount of phosphorus until degeneration was complete. When regeneration occurred, they returned to practically their normal condition. The amount of degeneration was measured by the extent of the Marchi reaction. Gutnikov [20] made elaborate chemical analyses of fifteen fœtal brains, of the brains of seven persons who, without previous illness, had died suddenly, and of the brains in thirty-one pathological conditions, comprising both mental and physical diseases. He estimated water, phosphorus, nitrogen and sulphur in both the dry and moist gray and white substances. From his numerous analyses I select only those that have a direct bearing upon this paper. In four cases of acute alcohol poisoning, the amounts of water and phosphorus were about

normal. In a case of general paralysis in a man of 42 who had died of heart paralysis following fatty degeneration, the water was increased in both the white and gray substances, the phosphorus of the gray substance was decreased to about one-half of its amount and in the white to about one-third. In a case of senile dementia in a man aged 73, who had died of senile marasmus, the water was increased in both the white and gray substance, and the phosphorus in the gray substance was decreased to about one-third and in the white to a little less than one-half its former amount. In another case of senile dementia who had died from exhaustion the phosphorus had diminished more than half. In a case of stuporous melancholia who had died from exhaustion the phosphorus was increased in the gray but diminished in the white matter. With regard to the above results on the quantitative estimation of phosphorus, three principles seem to have been clearly and uniformly established by independent observers. When degeneration occurs in the central nervous system, chemical analysis of the affected portions shows a diminution of lecithin and the phosphorus and an increase of water, the amounts being parallel with the extent of nerve degeneration.

This then is the present status of the chemistry of nerve degeneration as revealed by metabolic disturbances and the findings in the cerebrospinal fluid and the nerve tissue itself. It is very unsatisfactory and fragmentary, because metabolism has offered little; microchemical reactions have been limited to mere observation of morphological changes, and chromo- and cytodiagnosis of the cerebrospinal fluid, especially in the hands of the French investigators have, with a few exceptions, overshadowed everything else. But certain facts seem fundamental and well established, yet even these are somewhat invalidated, because bare chemical analyses were given, without any effort to harmonize them with the clinical picture and the anatomical findings. It is with these data in mind, as shown by the review of the literature given above and an earnest desire to simplify and elaborate them, with the not vain hope of establishing new facts, that the following investigations were undertaken. I have been extremely fortunate in being able to utilize the material of a large hospital like ours. My cases in all number thirty-four and comprise a large

range of psychoses. Instead of a mere mention of the diagnosis, I have given short abstracts of the cases in order that the reader may judge of the varying clinical picture under which the chemical products of nerve degeneration may appear in the cerebrospinal fluid. In addition, I have given the anatomical findings in the central nervous system in order to show what relation exists between the pathological anatomy and the results of the chemical analyses. With a few exceptions the fluid was obtained by lumbar puncture after death, the time varying from ten minutes to twenty hours. In the longer periods, the body was kept in cold storage so as to exclude all post-mortem changes. The reaction was taken with litmus and the specific gravity by means of an accurate urinometer. To detect the presence of lactic acid, both Uffelmann's and Kelling's tests were used. The reducing body was tested for by means of Fehling's solution and also by the formation of an osazon with phenylhydrazin and sodium acetate after removal of the proteid with acetic acid and heat. The amount of proteid was roughly determined by the appearance of the fluid after the addition of 95 per cent alcohol. The method for the isolation and the detection of cholin was as follows:

The proteids were first precipitated by the addition of an excess of 95 per cent alcohol and the filtered solution was evaporated to dryness over a water bath at 40° C. This was extracted with absolute alcohol, again filtered and evaporated to dryness, and the operation repeated, care being taken in all cases to keep the temperature low. By this means all traces of proteid and the potassium salts were removed. The final residue after extraction with absolute alcohol was of a light color and of a syrupy consistency, and was divided into two portions, one being dissolved in distilled water, the other in 15 per cent alcohol. The watery solution was tested for proteid by the ordinary tests (biuret, Millon's, xanthoproteic, Adamkiewicz'), and for cholin by the usual alkaloidal reagents. In all cases the proteid was found to have been entirely removed by the treatment with alcohol. The alkaloidal reagents used were tannic, phosphotungstic and phosphomolybdic acids, and occasionally iodine in potassium iodide and platinum and gold chloride. To the second solution in 15 per cent alcohol there

were added a few drops of a 4 per cent solution of platinum chloride, and this was allowed to evaporate in a watch-glass over calcium chloride. Cholin was not designated as present unless all of the following characteristics were found:

Tannic acid, no precipitate (thus distinguishing it from neurin).
Phosphotungstic acid, white precipitate.
Phosphomolybdic acid, yellow precipitate.
Gold chloride, yellow precipitate.
Platinum chloride, yellow precipitate.
Iodine in potassium iodide, brown precipitate.

The most important feature was the double platinum salt which was obtained on slow evaporation from the solution in 15 per cent alcohol. In all cases in which cholin was present, large, yellow octahedra were formed, in both single and twin crystals, and easily soluble in water, thus differing from the double salt of neurin. It was furthermore differentiated from any traces of the potassium salts, that might have failed of extraction with the absolute alcohol, by the large size and easy solubility in water of the cholin salt, and by the fact that the watery solution gave the alkaloidal reactions in all cases in which the double platinum compound was obtained. In a few cases the gold salt was isolated, which crystallized in golden yellow prisms or needles. For the isolation of cholin from the brain, the brain substance was macerated in a mortar and extracted for a long time with absolute alcohol, and after filtration and evaporation of the alcoholic extract to dryness, the same method was used as detailed above.

Case 1.—Female, aged 42. Alcoholic hallucinosis of three years' duration. During the last two years in the hospital she lost 84 lbs. in weight, and for two weeks before death there were fever, diarrhea, delirious stupor, rigidity, and marked general twitchings. The autopsy showed the cause of death to be pulmonary tuberculosis. Brain weight, 1360 grammes, no gross lesions or granulations in the 4th ventricle. The axonal reaction was found in the Betz cells of the para-central lobule. Marchi reaction of the corresponding fibres.

Cerebrospinal Fluid.—Amount, 10 cc.; color, opalescent; time after death, 45 minutes; proteid pp., small; cholin, absent.

Case 2.—Female, aged 41. Dementia præcox, of fourteen years' duration. Acute anterior poliomyelitis during childhood. For three days preceding death, there were marked rigidity and twitchings, fearful agitation,

fever, albuminuria, and acetonuria. The autopsy showed broncho-pneumonia to be the cause of death. Brain weight, 1210 grammes, no gross lesions, residuals of anterior poliomyelitis in the cord. The axonal reaction was present in the Betz cells of the para-central lobule. The urine was examined for toxic products by the Stas-Otto method, but the results, both chemically and physiologically, were entirely negative.

Cerebrospinal Fluid.—Amount, 50 cc.; time after death, 30 minutes; color, clear; proteid pp., small; cholin, present.

Cholin was also demonstrated in 100 cc. of blood removed from the pulmonary vein at the time of the autopsy.

Case 3.—Female, aged 46. Melancholia of two years' duration. There was some loss in weight for the last six months and for a week before death, slight fever, diarrhea, a little rigidity and a few twitchings were noted. The cause of death was broncho-pneumonia. Brain weight, 1160 grammes, no œdema or granulations in the 4th ventricle. Axonal reaction in the Betz cells of the para-central lobule.

Cerebrospinal Fluid.—Time after death, nine hours; amount, 35 cc.; color, clear; proteid pp., heavy; cholin, present.

Case 4.—Male, aged 42. General paralysis, expansive tabetic form with circular periods of stupor and excitement. Duration, five years. Cause of death, pulmonary œdema and lobar pneumonia. Brain weight, 1385 grammes; pia, œdematous and hazy; grayness of the posterior columns and roots of the cord.

Cerebrospinal Fluid.—Time after death, 15 hours; amount, 105 cc.; color, clear; reaction, neutral; spec. grav., 1010; proteid pp., heavy; reducing body, absent; cholin, present.

Case 5.—Male, aged 71. Senile dementia of two years' duration. Death from exhaustion. No autopsy.

Cerebrospinal Fluid.—Time after death, 1 hour; amount, 18 cc.; color, cloudy; proteid pp., very small; cholin, absent.

Case 6.—Female, aged 63. Manic-depressive insanity of 15 years' duration. The cause of death was cerebral hemorrhage and broncho-pneumonia. Brain weight, 1110 grammes; hemorrhage around the Sylvian fissures, occipital poles, cerebellum and tips of temporal lobes.

Cerebrospinal Fluid.—Time after death, 2½ hours; amount, 15 cc.; color, clear; proteid pp., small; cholin, absent.

Case 7.—Female, aged 71. Huntington's chorea of many years' duration. The cause of death was hypostatic pneumonia. Brain weight, 960 grammes; pia œdematous; no granulations in the 4th ventricle. Cerebellum of normal size.

Cerebrospinal Fluid.—Time after death, 6 hours; amount, 15 cc.; color, slightly cloudy; proteid pp., small; cholin, absent.

Case 8.—Male, aged 35. Alcoholic delirium. Death from pneumonia. Brain weight, 1330 grammes; slight haziness of the pia; convolutions a little atrophic.

Cerebrospinal Fluid.—Time after death, 6 hours; amount, 25 cc.; color, slightly blood-tinged (contamination). Proteid pp., small, cholin, absent.

CASE 9.—Female, aged 38. Epilepsy of 16 years' duration. Death in status epilepticus. Brain weight, 1355 grammes; pia thin, little œdema.

Cerebrospinal Fluid.—Time after death, 3 hours; amount, 30 cc.; color, slightly blood-tinged (contamination); proteid pp., small; cholin, absent.

CASE 10.—Male, aged 35. General paralysis of 11 months' duration. Death from hypostatic pneumonia, and for two days preceding death there were continuous epileptiform convulsions. No autopsy.

Cerebrospinal Fluid.—Time after death, 5 hours; amount, 10 cc.; color, clear; proteid pp., small; cholin, present.

CASE 11.—Female, aged 27. Dementia præcox of three years' duration. Cause of death, tuberculous broncho-pneumonia. Brain weight, 1240 grammes; no granulations in the 4th ventricle; tubercles in the pia at the junction of the medulla with the pons.

Cerebrospinal Fluid.—Time after death, 12 hours; amount, 25 cc.; color, slightly blood-tinged (contamination); proteid pp., small; cholin, absent.

CASE 12.—Male, aged 67. Senile melancholia of two years' duration with the typical attitude of Parkinson's disease. The cause of death was broncho-pneumonia. Brain weight, 1835 grammes; dura adherent; no œdema.

Cerebrospinal Fluid.—Time after death, 12 hours; amount, 10 cc.; color, clear; proteid pp., small; cholin, absent.

CASE 13.—Male, aged 64. Senile dementia. For four days preceding death there were semi-stupor, refusal of food, slight rigidity and twitchings. Death from exhaustion. Brain weight, 1210 grammes; considerable œdema; no granulations in the 4th ventricle. No axonal reaction of the Betz cells of the para-central lobule.

Cerebrospinal Fluid.—Time after death, 5 hours; amount, 10 cc.; color, clear; proteid pp., very small; cholin, absent.

CASE 14.—Male, aged 47. General paralysis of 8 years' duration. The cause of death was asphyxia from aspiration of vomitus. No autopsy.

Cerebrospinal Fluid.—Time after death, 12 hours; amount, 65 cc.; color, clear straw; proteid pp., large; reaction slightly acid; lactic acid, present; spec. grav., 1009; reducing body, present; cholin, present.

Microscopically.—A large number of small mononuclear cells and a few polynuclear and red blood cells. No cholesterin. No osazon was found with phenylhydrazin and the sodium acetate.

CASE 15.—Male, aged 36. General paralysis of two years' duration. Death from hypostatic pneumonia. No autopsy.

Cerebrospinal Fluid.—Time after death, 45 minutes; amount, 20 cc.; color, clear straw; reaction, slightly acid; trace of lactic acid; proteid pp., large; cholin, present.

Case 16.—Male, 47 years of age. General paralysis of 5 years' duration. Death from hypostatic pneumonia. Brain weight, 1185 grammes; pia œdematous and milky; granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 11 hours; amount, 20 cc.; color, cloudy; proteid pp., large; cholin, present.

Case 17.—Male, aged 50. Alcoholic hallucinosis of four months' duration. For three weeks before death there were rapid emaciation, diarrhea, delirious stupor, rigidity and twitchings. The autopsy showed death to be due to broncho-pneumonia. Brain weight, 1610 grammes; slight haziness of the pia. No granulations in the 4th ventricle. The axonal reaction was found in the Betz cells of the para-central lobule.

Cerebrospinal Fluid.—Time after death, 10 hours; amount, 20 cc.; color, clear; proteid pp., small; cholin, present.

Case 18.—Male, aged 56. General paralysis of four years' duration. The cause of death was hypostatic pneumonia. No autopsy.

Cerebrospinal Fluid.—Time after death, 7 hours; amount, 40 cc.; color, cloudy yellow; reaction, slightly acid; lactic acid, present; proteid pp., large; cholin, present.

Case 19.—Female, aged 40. General paralysis of six years' duration. Death from pulmonary tuberculosis. Brain weight, 950 grammes; thickened and hazy pia; subdural hemorrhage in both the brain and cord. The brain substance was soft and flabby, the convolutions atrophic, the temporal lobes adherent and there were granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 45 minutes, amount, 50 cc.; color, very bloody; proteid pp., very large (due to the serum albumin and globulin); cholin, present.

Case 20.—Male, aged 40. General paralysis of two years' duration. Death from hypostatic pneumonia. Brain weight, 1195 grammes; thickened dura; atrophic convolutions; granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, two hours; amount, 17 cc.; color, slightly cloudy; reaction, neutral; proteid pp., large; cholin, present.

Case 21.—Male, aged 41. General paralysis of three years' duration. The cause of death was septicæmia from decubitus. Brain weight, 1105 grammes. Pia very œdematous and opaque; convolutions markedly atrophic; no granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 30 minutes; amount, 66 cc.; color, clear; reaction, slightly acid; lactic acid, trace; spec. grav., 1008; proteid pp., very large; reducing body, present; cholin, present.

Case 22.—Female, aged 45. Melancholia of 1½ years' duration. The patient was stuporous and resistive and for a couple of days before death there were marked rigidity and some twitchings. The cause of death was pulmonary tuberculosis. Brain weight, 1195 grammes; vessels thickened; no granulations in the 4th ventricle. The axonal reaction was found in the Betz cells of the para-central lobule.

Cerebrospinal Fluid.—Time after death, 1 hour; amount, 25 cc.; color, clear; proteid pp., very small; cholin, absent.

CASE 23.—Male, aged 39. General paralysis of two years' duration. Death was due to continual epileptiform convulsions. No autopsy.

Cerebrospinal Fluid.—Time after death, 10 minutes; amount, 65 cc.; color, clear and slightly yellow; reaction, slightly acid; lactic acid, present; spec. grav., 1006; proteid pp., very large; reducing body, present; cholin, present.

CASE 24.—Male, aged 29. Delirium tremens of five days' duration. For several hours before death the temperature was 107.3° F. Death from lobar pneumonia. Brain weight, 1370 grammes. Pia hazy, injected and markedly œdematous.

Cerebrospinal Fluid.—Time after death, 30 minutes; amount, 100 cc.; color, clear and slightly yellow; reaction, slightly acid; lactic acid, present; spec. grav., 1010; proteid pp., small; reducing body, present (marked reduction of Fehling's solution); cholin, present.

With phenylhydrazin and sodium acetate an osazon was formed resembling phenylglucosazon (fine yellow needles arranged in sheaves). Cholin was also demonstrated in 10 grammes of brain tissue taken from the first right frontal convolution.

CASE 25.—Male, aged 42. General paralysis of five years' duration. Death from exhaustion. Brain weight, 1220 grammes; considerable œdema; thickened and adherent dura; no granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 8 hours; amount, 125 cc.; color, clear, slightly yellow; spec. grav., 1010; reaction, slightly acid; lactic acid, present; proteid pp., heavy; cholin, present.

Cholin was also found in 5 grammes of brain tissue taken from the first left frontal convolution.

CASE 26.—Male, aged 37. Delirium tremens of three days' duration. Death from lobar pneumonia. No autopsy.

Cerebrospinal Fluid.—Time after death, 4½ hours; amount, 20 cc.; color, clear, slightly yellow; proteid pp., very small; cholin, present.

CASE 27.—Female, aged 71. Organic dementia (aphasia) of seven years' duration. The cause of death was broncho-pneumonia. Brain weight, 990 grammes; adherent dura; considerable œdema; pia hazy and opaque over the right central area. There was marked atrophy of the posterior central regions in both hemispheres; the cisterna was hazy, and the first left frontal convolution was softened. There were no granulations in the 4th ventricle. Pigmentary degeneration of the Betz cells of the para-central lobule.

Cerebrospinal Fluid.—Time after death, 2½ hours; amount, 115 cc.; color, slightly bloody (contamination); proteid pp., heavy; cholin, present.

CASE 28.—Male, aged 31. Alcoholic depressive hallucinosis of 22 months' duration with a loss of 83 lbs. during this period. There was some slight diarrhea before death which resulted from exhaustion. Brain weight, 1595 grammes; dura thickened; substance rather soft in the posterior portions of both hemispheres. There were no granulations in the 4th ventricle. The Betz cells of the para-central lobule were deeply stained, both the protoplasm and the nucleus, and to a considerable distance into the processes.

Cerebrospinal Fluid.—Time after death, 1½ hours; amount, 40 cc.; color, cloudy; proteid pp., moderate; cholin, present.

CASE 29.—Male, aged 55. General paralysis of one year's duration. The cause of death was hypostatic pneumonia. Brain weight, 1300 grammes; pia hazy and markedly injected; granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 15 minutes; amount, 35 cc.; color, clear; proteid pp., moderate; cholin, present.

Cholin was also found in 5 grammes of brain tissue taken from right frontal lobe.

CASE 30.—Female, aged 37. Toxic delirium of 11 days' duration. The cause of death was exhaustion from uncontrollable emesis, the vomitus being of a coffee-ground color. Brain weight, 1540 grammes; adherent dura; cloudy pia; sclerosis of the basal vessels. The 4th ventricle was free from granulations. Carcinoma of the pylorus and first part of the duodenum.

Cerebrospinal Fluid.—Time after death, 12 hours; amount, 45 cc.; color, bloody (contamination); proteid pp., large; cholin, absent.

No cholin could be demonstrated in 5 grammes of brain tissue taken from the first right frontal convolution.

CASE 31.—Male, aged 32. General paralysis of 19 months' duration. Death from hypostatic pneumonia. Brain weight, 1195 grammes; pia œdematous and hazy; granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 20 hours; amount, 145 cc.; color, bloody (contamination); proteid pp., heavy; cholin, present.

Cholin was also found in 10 grammes of brain tissue taken from the first left frontal convolution.

CASE 32.—Male, aged 36. General paralysis of 3½ years' duration. Death from lobar pneumonia. Brain weight, 1170 grammes; dura thickened; pia hazy and œdematous. The frontal lobes were soft, the convolutions narrow and the right post-central and pre-central convolutions were markedly atrophic. Granulations in the 4th ventricle.

Cerebrospinal Fluid.—Time after death, 18 hours; amount, 150 cc.; color, bloody (contamination); proteid pp., heavy; cholin, present.

Cholin was also found in 5 grammes of brain tissue from the first right frontal convolution.

CASE 33.—Male, aged 52. Organic dementia (aphasia) of 23 months' duration. Death was sudden from acute dilatation of the heart. Brain

weight, 1250 grammes; dura strongly adherent; pia hazy and thickened along the longitudinal fissure. There was atrophy of the first left frontal convolution with a depressed cicatrix in its inferior portion.

Cerebrospinal Fluid.—Time after death, 9 hours; amount, 70 cc.; color, bloody (contamination); proteid pp., heavy; cholin, present.

Cholin was also found in 5 grammes of brain tissue taken from the first right frontal convolution.

CASE 34.—Female, aged 40. Dementia præcox of 2½ years' duration. The chief features of the psychosis were a depressive persecutory hallucinosis, fear, sudden outbursts of violence without apparent provocation, a period of mutism with refusal of food and stereotyped attitudes and finally absurd expansive ideas. Within seven months the weight decreased 13 lbs., and for the last four months there was increasing weakness and finally persistent diarrhea. Suddenly there developed general explosive twitchings and jerkings, fever and semi-stupor, the twitchings being rather more marked on the left side. There was rapid failure, and after the above phenomena had continued for two days, the patient died. The autopsy showed death to be due to broncho-pneumonia. Brain weight, 1035 grammes; moderate amount of œdema; pia injected; frontal convolutions somewhat atrophic; small linear depression in first left temporal convolution; no granulations in the 4th ventricle. There was a well-marked axonal reaction in a few of the Betz cells of the left para-central lobule; in the right para-central lobule many cells were involved.

Cerebrospinal Fluid.—Amount, 75 cc.; time after death, 45 minutes; color, bloody (contamination); proteid pp., heavy; cholin, present.

Cholin was also present in 10 grammes of brain tissue taken from the first right frontal convolution.

Having grouped the clinical picture with the chemical and anatomical findings, for the sake of convenience and clearness, I tabulate the chemical analyses above. The numbers correspond to the cases.

The fluid was obtained at times varying from ten minutes to twenty hours after death; in the longer periods the remains were kept at a low temperature in order to avoid post-mortem changes. The amounts obtained showed a wide range, from 10 cc. to 150 cc. The figures in the alcoholic cases (hallucinosis, delirium, depression, delirium tremens) varied from 10 cc. to 100 cc., the latter and largest amount being in a case of delirium tremens (Case 24). In this case, the pia was very hazy and markedly œdematous and the amount of fluid was only equalled in some of the general paralytics. In two cases of dementia præcox the amounts were 50 cc. and 25 cc., respectively, and

TABLE OF FINDINGS IN THE CEREBROSPINAL FLUID.—(THE NUMBERS CORRESPOND TO THE CASES.)

Case.	Psychosis.	Time after death.	Amt.	Color.	Reaction.	Lactic acid.	Spec. Grav.	Proteid.	Reducing body.	Cholin.	Remarks.
1	Alcoholic Hallucinosis	45 min.	10 cc.	Opalescent.	.....	....	....	Small amt.	.....	Absent.	.....
2	Dementia Præcox.	30 min.	50 cc.	Clear.	.....	....	....	Small amt.	.....	Present.	Cholin also found in the blood.
3	Melancholia	9 hrs.	35 cc.	Clear.	.....	....	....	Large amt.	.....	Present.	.....
4	General Paralysis (expansive tabetic form).....	15 hrs.	105 cc.	Clear.	Neutral.	....	1010	Heavy amt.	Absent.	Present.	.....
5	Senile Dementia ..	1 hr.	18 cc.	Cloudy.	.....	....	....	Very small amount.	.....	Absent.	.....
6	Manic-depressive Insanity	2½ hrs.	15 cc.	Clear.	.....	....	....	Small amt.	.....	Absent.	.....
7	Huntington's Chorea	6 hrs.	15 cc.	Slightly cloudy.	.....	....	....	Small amt.	.....	Absent.	.....
8	Alcoholic Delirium	6 hrs.	25 cc.	Slightly blood-tinged.	.....	....	....	Small amt.	.....	Absent.	.....
9	Epilepsy	3 hrs.	30 cc.	Slightly blood-tinged.	.....	....	....	Small amt.	.....	Absent.	.....
10	General Paralysis .	5 hrs.	10 cc.	Clear.	.....	....	....	Small amt.	.....	Present.	....
11	Dementia Præcox .	12 hrs.	25 cc.	Slightly blood-tinged.	.....	....	....	Small amt.	.....	Absent.	.....

TABLE OF FINDINGS IN THE CEREBROSPINAL FLUID.—(THE NUMBERS CORRESPOND TO THE CASES.)—Continued.

Case.	Psychosis.	Time after death.	Amt.	Color.	Reaction.	Lactic acid.	Spec. Grav.	Proteid.	Reducing body.	Cholin.	Remarks.
12	Senile Melancholia.	12 hrs.	10 cc.	Slightly blood-tinged.	.....	....	....	Small amt.	.....	Absent.	.....
13	Senile Dementia..	5 hrs.	10 cc.	Clear.	.....	....	....	Very small amount.	.....	Absent.	.....
14	General Paralysis .	12 hrs.	65 cc.	Clear, straw color.	Slightly acid.	Present.	1009	Large amt.	Present.	Present.	No osazon found.
15	General Paralysis .	45 min.	20 cc.	Clear, straw color.	Slightly acid.	Trace.	....	Large amt.	.....	Present.	.....
16	General Paralysis .	11 hrs.	20 cc.	Cloudy.	.....	....	....	Large amt.	.....	Present.	.....
17	Alcoholic Hallucinosis	10 hrs.	20 cc.	Clear.	.....	....	....	Small amt.	.....	Present.	Only a very few crystals of the platinum salt obtained.
18	General Paralysis .	7 hrs.	40 cc.	Cloudy, yellow.	Slightly acid.	Present	....	Large amt.	.....	Present.	.....
19	General Paralysis .	45 min.	50 cc.	Very bloody.	.....	....	....	Very large amount.	.....	Present.	Color not due to contamination, fluid clotted like blood.
20	General Paralysis .	2 hrs.	17 cc.	Slightly cloudy.	Neutral.	....	....	Large amt.	.....	Present.	.....
21	General Paralysis .	30 min.	66 cc.	Clear.	Slightly acid.	Trace.	1008	Very large amount.	Present.	Present.	.....
22	Melancholia	1 hr.	25 cc.	Clear.	.....	....	....	Very small amount.	.....	Absent.	.....

TABLE OF FINDINGS IN THE CEREBROSPINAL FLUID.—(THE NUMBERS CORRESPOND TO THE CASES.)—Continued.

Case.	Psychosis.	Time after death.	Amt.	Color.	Reaction.	Lactic acid.	Spec. grav.	Proteid.	Reducing body.	Cholin.	Remarks.
23	General Paralysis .	10 min.	65 cc.	Clear, sl. yellow.	Slightly acid.	Present	1006	Very large amount.	Present.	Present.	.....
24	Delirium Tremens.	30 min.	100 cc.	Clear, sl. y ellow.	Slightly acid.	Present	1010	Small amt.	Present (marked).	Present.	Osazon found resembling phenylglucosazon; cholin also found in right frontal lobe.
25	General Paralysis .	8 hrs.	125 cc.	Clear, yellow.	Slightly acid.	Present	1010	Large amt.	.....	Present.	Cholin also found in left frontal lobe.
26	Delirium Tremens.	4½ hrs.	20 cc.	Clear, yellow.	.....	....	....	Very small amount.	.....	Present.	.....
27	Organic Dementia (aphasia).....	2½ hrs.	115 cc.	Slightly bloody.	.....	....	....	Large amt.	....	Present.	.....
28	Alcoholic Depression.....	1½ hrs.	40 cc.	Cloudy.	.....	....	....	Mod. amt.	.....	Present.	.....
29	General Paralysis .	15 min.	35 cc.	Clear.	.....	....	....	Mod. amt.	.....	Present.	Cholin was found in right frontal lobe.
30	Toxic Delirium ...	15 hrs.	45 cc.	Bloody.	.....	....	....	Heavy amt.	.....	Absent.	No cholin found in right frontal lobe.
31	General Paralysis .	20 hrs.	145 cc.	Bloody.	.....	....	....	Heavy amt.	.....	Present.	Cholin found in left frontal lobe.
32	General Paralysis .	18 hrs.	150 cc.	Bloody.	.....	....	....	Heavy amt.	.....	Present.	Cholin found in right frontal lobe
33	Organic Dementia (aphasia).....	9 hrs.	70 cc.	Bloody.	.....	....	....	Heavy amt.	.....	Present.	Cholin found in right frontal lobe.
34	Dementia Præcox.	45 min.	75 cc.	Bloody.	.....	....	....	Heavy amt.	.....	Present.	Cholin found in right frontal lobe.

three of melancholia including the senile form, 35 cc., 10 cc., and 25 cc. But, as will be later shown, in some of this group of alcoholic psychoses, melancholia and dementia præcox, the fluid was obtained only at a terminal stage, in which there appeared a peculiar symptom-complex, which gave rise in those previously purely "functional" disorders to marked "organic" cell changes. In some of these, at least, the chemical findings were different and served to establish a harmony with the pathological picture which will be further elaborated in more detail. The largest amounts of cerebrospinal fluid were obtained in the cases of general paralysis. Here, on account of the pial œdema which is so characteristic of this disease, there were obtained in fourteen cases, amounts varying from 10 cc. to 150 cc. In four of these, the amount was over 100 cc., in four others at or above 50 cc. In two cases of senile dementia the amounts were small, 10 cc. and 18 cc.; in a manic depressive case associated with residuals of a cerebral hemorrhage and in a case of Huntington's chorea, only 15 cc. could be obtained. In an epileptic who died in status epilepticus only 30 cc. was secured, less than half of the amount than was obtained in a case of general paralysis who died in continual epileptiform seizures (Case 23). Two cases of organic dementia associated with aphasia yielded 115 cc. and 70 cc., respectively. In the case of a delirium appearing in the course of a gastric cancer the amount was 45 cc. The color was either clear, opalescent or straw-colored, except in a general paralytic with subdural hemorrhage (Case 19) and in those few instances where contamination accidentally took place.

The reaction in two cases of general paralysis was neutral and in these the fluid was obtained 17 hours and two hours after death, respectively. In seven other cases the reaction was acid, this probably being due to the post-mortem changes which had already set in. Why it should be neutral in Case 4, when it was obtained 15 hours after death and acid in other cases in which death was not due to convulsions, and yet the fluid was obtained at much shorter periods, is inexplicable. The acidity was due in all cases to lactic acid. Case 23 is particularly valuable, for here the patient died in continuous epileptiform convulsions, and, although the fluid was obtained ten minutes after death and was still warm, yet lactic acid was present. This can

only be explained on the basis that the nerve tissue becomes acid in long continued activity, just as the working muscle produces sarcolactic acid, and that this acid (optically inactive lactic acid) passed into the cerebrospinal fluid.

The specific gravity varied from 1006 to 1009, the amount of proteid present not affecting it; nor can any difference be noted in any of the various psychoses. The amount of proteid precipitate was smallest in the alcoholic psychoses, whatever their terminal disorder, and largest in the general paralytics, only one of these showing a small amount. In senile dementia and melancholia it was also small, but large in one case of involution melancholia and small in another, but both of these were associated with cortical cell changes. Two cases of dementia præcox, one of Huntington's chorea, and one of epilepsy, showed a small amount, but it was large in two cases of organic dementia and also in one case of toxic delirium. In a manic-depressive case, associated with the residuals of a crebral hemorrhage, it was also small.

The reducing body was tested for in five cases. It was found absent in one case of general paralysis, but present in three others, and also in a case of delirium tremens. The failure to detect it in Case 4, was probably due to the long period which had elapsed after death, because the reducing property of the cerebrospinal fluid gradually diminishes after death, until it finally ceases to react at all. In Case 24, an osazon compound was obtained whose morphology exactly resembled phenylglucosazon, although no effort was made to determine the melting point.

Cholin was tested for in all of the cases and found absent in eleven and present in twenty-three. In one where it was present in the cerebrospinal fluid it was also demonstrated in the blood; in six cases it was found both in the fluid and in several grammes of brain tissue taken either from the first right or left frontal convolution. In one case it was absent both from the fluid and also the brain. It was demonstrated in two terminal disorders of dementia præcox (Cases 2 and 34), melancholia (Case 3), and in an alcoholic depressive hallucinosis (Case 17) characterized clinically by emaciation, diarrhea, fever, delirium or stupor, rigidity or general twitchings and anatom-

ically by the axonal reaction of the Betz cells of the para-central lobule with the Marchi reaction of the corresponding fibres." In one of these (Case 2) it was also found in the blood by the same method as detailed for the cerebrospinal fluid, but here the findings are open to question for the reason that it might have been derived from the lecithin which is a constituent of the stroma of the red cells. In Case 34, belonging to this group, cholin was also demonstrated in the brain. In Cases 1 and 22, which also had the syndrome of these terminal disorders, it was absent, although in both the amount and intensity of the cell destruction was equal to that in the other cases. In another case of alcoholic depressive hallucinosis (Case 28) cholin was also present, and although this did not present the typical clinical picture, yet there were diarrhea and extreme emaciation, and the Betz cells of the para-central lobule revealed changes which resembled an acute alteration.

In fourteen cases of general paralysis, cholin was constantly present and in four of these it was coincidently found in the first right or left frontal convolutions. In these four there was marked brain atrophy and in addition, in Case 32, there was some softening of the frontal lobes. The brain weights in these four cases averaged about 1220 grammes. All the cases of general paralysis were characterized macroscopically by cortical injection, œdematous and adherent pia, granulations in the 4th ventricle and a diminution in the brain weight, and microscopically by the characteristic cell alteration, gliosis and vascular infiltration. The presence of cholin in this disease can be explained by the intense and comparatively rapid cortical degeneration. In two cases of senile dementia (Cases 5 and 13) it was absent, which can be explained on the basis of the extremely slow atrophy that takes place in this disease. In another case of senile organic dementia (Case 27) cholin was present, but here associated with extreme artophy (brain weight only 990 grammes), with softening of the first left frontal convolution, pigmentary degeneration of the Betz cells and aphasic speech disturbance. In another case of organic dementia (Case 33) with aphasia, cholin was also present in both the fluid and the brain. It was absent in a case of manic-depressive insanity, Huntington's chorea, alcoholic delirium, epilepsy, dementia

præcox with death from tuberculous broncho-pneumonia, senile melancholia and in a toxic delirium occurring in the course of a scirrhus cancer of the pylorus and first portion of the duodenum. In the latter case it was also absent from the brain. Cholin was present in two cases of delirium tremens (Cases 24 and 26). In one of these there was hyperpyrexia before death and the pia was markedly œdematous; in the other case there was no autopsy. Its presence here can be explained as the result of the intense acute alteration of the cells, due in both cases to the high fever.

In the cases associated with cholin, the amount of proteid was small in four, moderate in two and large in seventeen, an interesting coincidence by which one can harmonize the amount of tissue destruction with the appearance of the lecithin decomposition products in the cerebrospinal fluid. The amounts of fluid do not compare so favorably, yet if all of it had been obtained, we should undoubtedly see the relation between the pial œdema and the myelin degeneration. No effort was made to determine the quantitative relation between the amount of cholin and the extent of nerve degeneration, the tests being only qualitative, with the feeling that the mere demonstration of a substance so abnormal was of sufficient importance, without any final resort to quantitative accuracy. We have here a method that delicately determines the results of nerve degeneration and it is an almost positive proof that degeneration cell alteration or both exist in the central nervous system, when its katabolic product, cholin, appears in the cerebrospinal fluid. For the present we can say that the findings furnish a fairly safe guide for the differential diagnosis between organic and functional nervous and mental disorders, and this diagnostic aid can be utilized during life by the examination of the cerebrospinal fluid, obtained by lumbar puncture, for cholin. It appears that cholin is present at any period of myelin degeneration, as shown by the duration of the cases cited, whether during the swelling of the axon, the collection of the fat droplets along the course of the nerve, the liquefaction of the myelin or after its absorption. Various disorders do not change the chemical findings, whether in general paralysis with its extensive degeneration and atrophy, in the organic dementias with their focal

lesions, in delirium tremens with its acute cell alteration, and finally in those terminal disorders of the various depressive states already considered, with their central fibre degeneration and the secondary reaction upon the nerve cell, the result perhaps of autogenous poisons circulating in the blood and derived from the katabolic products which follow the extreme emaciation.

BIBLIOGRAPHY.

1. K. Hasebrook: Ztschr. für phys. Chemie, Bd. XII, S. 148, 1888.
2. G. Nya: Rivista di Patologia nervosa e mentale, Sept., 1898.
3. Jean Abadie: Le Semaine médicale, Juillet 28, 1901.
4. John Turner: Brain, vol. XXII, 1899.
5. T. Panzer: Münch. med. Wchnschr., Aug. 3, 1899.
6. T. Panzer: Loc. cit.
7. Cavazzini: Centralb. für Physiol., Bd. X, Nr. 6, S. 145, 1896.
8. Nauratzski: Ztschr. für. phys. Chemie, Bd. XXIII, S. 532, 1897.
9. Schaefer: Ueber das Verhalten der Cerebrospinalflüssigkeit bei Dementia Paralytica und einigen anderen Formen des Schwachsinns. Allg. Ztschr. f. Psychiatrie und psychisch-gerichtliche Med., April, 1902, Bd. LIX.
10. Pellagrini: La Riforma Medica, Roma, 1901. Ann. 17, t. II, p. 638.
11. W. D. Halliburton: The Croonian Lectures on the Chemical Side of Nervous Activity, 1901.
12. W. D. Halliburton and F. W. Mott: The Physiological Action of Cholin and Neurin. Philosoph. Transactions, No. 7, 1899.
13. Horatio C. Wood, Jr.: On the Toxic Action of the Decomposition Products of Lecithin. Univ. of Penn. Med. Bull., May, 1902.
14. O. Folin and P. A. Shaffer: On Phosphate Metabolism. Am. Jour. Physiol., April, 1902, vol. VII, No. 1.
15. Laborde: Comptes Rendus de l'Acad. des Sciences, 1901.
16. A. Noll: Ueber die quantitativen Beziehungen des Protagon zum Nervenmark. Ztschr. für phys. Chemie, Bd. XXVII, Hft. 4 u. 5, 1899.
17. F. W. Mott and J. O. Wakelin Barrett: Observations on the Chemistry of Nerve Degeneration. Archives of Neurology, 1899.
18. Barrett: On the amount of Phosphorus contained in the Cerebral Hemispheres of General Paralysis of the Insane and in other conditions. Archives of Neurology, 1899.
19. Halliburton: The Croonian Lectures on the Chemical Side of Nervous Activity, 1901.
20. S. Gutnikov: Zur Lehre von der chemischen Zusammensetzung des menschlichen Gehirns. Ztschr. für Psychiatrie, Bd. LIII, S. 270-329, 1897.
21. Adolf Meyer: On Parenchymatous Systemic Degenerations, mainly in the Central Nervous System. Brain, Part XCIII, 1901.

DERMATOSES OF THE INSANE.

A REPORT OF AN EXAMINATION OF THE PATIENTS OF THE LONG ISLAND STATE HOSPITAL FOR THE INSANE.[1]

By JAMES MacFARLANE WINFIELD, M. D., New York City,

Lecturer on Dermatology, Long Island College Hospital; Chief of Dermatological Clinic, Polhemus Memorial Clinic; Dermatologist to Kings County Hospital; Consulting Dermatologist to Long Island State, Nassau, Eastern District, and St. John's (Brooklyn) Hospitals.

That the insane might be subjects of skin disorders, especially those of neurotic origin, is a natural assumption.

For some time it had been my desire to make investigations to determine whether the mentally unsound were more or less afflicted with dermatological diseases than those in full possession of their mental faculties. During the past year I have been able to make the necessary examination.

In writing the paper for presentation before this Association, it was difficult to arrange and condense the data for easy reference; knowing how extremely tiresome and confusing a long series of statistics are when embodied in a paper, I have prepared a reference table, leaving the paper to emphasize only the important and interesting cases.

There are over twelve hundred patients in the institution, but only one thousand and eighty-four were examined, for many were in a highly excited state, and others were variously employed about the buildings.

The ages of the patients ranged from fifteen to eighty-one years; some had been insane for over thirty years, and had been inmates of this asylum for more than twenty years. Many of the others were recent admissions. They were natives of all parts of the world, the majority being from the United States and Ireland.

[1] Read before the American Dermatological Association, Sept. 19, 1902.

Following the custom of the State institutions the nativity and not the nationality of the patient is given. Thus, for instance, it will be seen, in the table, that although one was from Japan he was not a Japanese but of English parentage.

The classification of the mental disease is the same as that on the admission card.

In comparing the actual number of patients examined (one thousand and eighty-four) with the tabulated total (one thousand one hundred and seven) there is a difference of twenty-three. The reason for this is that some patients had two or three distinct skin diseases, as for instance, atrophia cutis was often associated with hypertrichosis, etc.

In making the examinations nothing that was not clinically evident was noted; no reliance being placed on the histories given by the patients. The clothing of the patients was removed so that all parts of the skin could be examined.

The skin affections were distributed among the various forms of insanity as follows. As nearly half of the patients examined were terminal dements, the greatest number of dermatological disorders were found in this class. Among them there were fifty-seven cases of true skin disease, and one hundred and one of degenerative dermatoses. Out of the acute and chronic melancholiacs twenty-two had distinct skin affections, and sixty-nine presented cutaneous degenerations. Of the acute and chronic maniacs fifteen had some form of skin disease, and thirty-eight, cutaneous degenerations. Fifteen of the paranoiacs had skin disease, and twenty-nine showed evidences of degenerations. In the paretics, ten had skin disease, twelve, degenerations. Thirteen cases of skin disease were found among the epileptics, while seven were examples of degenerative dermatoses.

The imbeciles, idiots, and patients with primary, secondary, recurrent, alcoholic and puerperal dementia, and circular insanity were nearly negative regarding any skin disease, or defect, there being only six instances of true skin disease, and but ten examples of degeneration among forty-eight patients.

Of the eleven cases of eczema, three were occupational, the women being employed in the kitchen.

The acne was in the eight epileptics undoubtedly due to the drugs employed to control the seizures.

It was impossible to trace the origin of the solitary case of scabies; the patient had been an inmate of the institution for many years.

Of the twenty-four cases of seborrhœa, thirteen involved the scalp, ten were on the chest and back, and one was axillary.

The epitheliomata were all facial. A rather interesting feature was that all of the patients suffering from epithelioma were under forty years of age.

Although syphilis is a recognized factor in certain forms of insanity, manifestations were found only seventeen times in this institution. This at first is rather surprising, but it must be remembered that only cases showing actual evidences of the disease were noted; a number of other patients had suspicious signs, but for lack of corroboration they were not included in the report.

It will be seen, however, that nearly fifty per cent of the syphilitics were paretics; the rest were distributed among the terminal dements, melancholiacs, and primary monomaniacs (paranoia).

There was only one case of secondary syphilis; this was in a patient suffering from acute melancholia.

All but one of the cases of seborrhoic warts occurred in patients over fifty years of age; the exception was in a woman not quite forty. In one patient the warts were scattered over the back; in all the rest they were facial.

The case of Paget's disease occurred in a female epileptic. The dermatitis presented all the clinical characteristics of this disease, but unfortunately confirmatory microscopical evidences are lacking.

The case of sarcoma cutis is interesting because of its rapid

[1] Since the above paper was written, the patient suffering from a malignant growth, classed in the table as sarcoma cutis, has died. The cutaneous infiltration continued to increase until it bore a typical appearance to the cancer en cuirasse of Velpeau. The autopsy and microscopical findings were furnished me by Dr. Warren.

Autopsy performed twenty-four hours after death. Upon inspection the tissues over the anterior thoracic and abdominal walls were found to be very much thickened, indurated and nodular; the skin of both arms and hands thickened and œdematous.

Upon section the thoracic and abdominal walls were found to be about 2½ or 3 inches thick, and greatly indurated, it being difficult to

Following the custom of the State institutions the nativity and not the nationality of the patient is given. Thus, for instance, it will be seen, in the table, that although one was from Japan he was not a Japanese but of English parentage.

The classification of the mental disease is the same as that on the admission card.

In comparing the actual number of patients examined (one thousand and eighty-four) with the tabulated total (one thousand one hundred and seven) there is a difference of twenty-three. The reason for this is that some patients had two or three distinct skin diseases, as for instance, atrophia cutis was often associated with hypertrichosis, etc.

In making the examinations nothing that was not clinically evident was noted; no reliance being placed on the histories given by the patients. The clothing of the patients was removed so that all parts of the skin could be examined.

The skin affections were distributed among the various forms of insanity as follows. As nearly half of the patients examined were terminal dements, the greatest number of dermatological disorders were found in this class. Among them there were fifty-seven cases of true skin disease, and one hundred and one of degenerative dermatoses. Out of the acute and chronic melancholiacs twenty-two had distinct skin affections, and sixty-nine presented cutaneous degenerations. Of the acute and chronic maniacs fifteen had some form of skin disease, and thirty-eight, cutaneous degenerations. Fifteen of the paranoiacs had skin disease, and twenty-nine showed evidences of degenerations. In the paretics, ten had skin disease, twelve, degenerations. Thirteen cases of skin disease were found among the epileptics, while seven were examples of degenerative dermatoses.

The imbeciles, idiots, and patients with primary, secondary, recurrent, alcoholic and puerperal dementia, and circular insanity were nearly negative regarding any skin disease, or defect, there being only six instances of true skin disease, and but ten examples of degeneration among forty-eight patients.

Of the eleven cases of eczema, three were occupational, the women being employed in the kitchen.

The acne was in the eight epileptics undoubtedly due to the drugs employed to control the seizures.

It was impossible to trace the origin of the solitary case of scabies; the patient had been an inmate of the institution for many years.

Of the twenty-four cases of seborrhœa, thirteen involved the scalp, ten were on the chest and back, and one was axillary.

The epitheliomata were all facial. A rather interesting feature was that all of the patients suffering from epithelioma were under forty years of age.

Although syphilis is a recognized factor in certain forms of insanity, manifestations were found only seventeen times in this institution. This at first is rather surprising, but it must be remembered that only cases showing actual evidences of the disease were noted; a number of other patients had suspicious signs, but for lack of corroboration they were not included in the report.

It will be seen, however, that nearly fifty per cent of the syphilitics were paretics; the rest were distributed among the terminal dements, melancholiacs, and primary monomaniacs (paranoia).

There was only one case of secondary syphilis; this was in a patient suffering from acute melancholia.

All but one of the cases of seborrhoic warts occurred in patients over fifty years of age; the exception was in a woman not quite forty. In one patient the warts were scattered over the back; in all the rest they were facial.

The case of Paget's disease occurred in a female epileptic. The dermatitis presented all the clinical characteristics of this disease, but unfortunately confirmatory microscopical evidences are lacking.

The case of sarcoma cutis is interesting because of its rapid

[3] Since the above paper was written, the patient suffering from a malignant growth, classed in the table as sarcoma cutis, has died. The cutaneous infiltration continued to increase until it bore a typical appearance to the cancer en cuirasse of Velpeau. The autopsy and microscopical findings were furnished me by Dr. Warren.

Autopsy performed twenty-four hours after death. Upon inspection the tissues over the anterior thoracic and abdominal walls were found to be very much thickened, indurated and nodular; the skin of both arms and hands thickened and œdematous.

Upon section the thoracic and abdominal walls were found to be about 2½ or 3 inches thick, and greatly indurated, it being difficult to

growth. The patient was a German woman aged seventy-seven; she had been an inmate of the asylum for over nineteen years. In April, 1902, I discovered a hard tumor, one and one-half by three inches in size, situated deep in the skin of the abdomen just under the left mammary gland; the skin over the growth was glossy and of a dark bluish color. The right nipple and part of the mammary gland had been removed, presumably for cancer, some time previous to her admission to this institution (at least twenty years ago). No tumors could be felt in the remaining portion of the gland nor in the other mamma.

The patient was again seen on August 1, 1902. The growth had rapidly increased and now involved nearly all of the skin of the abdomen, chest and arms and a part of the back. The forearms and hands were greatly swollen from pressure upon the superficial vessels. The growth seemed to be only cutaneous; the skin was greatly thickened, hard, bluish and glossy. Scattered over the affected area were a number of various-sized dark red tumors, some of them suggestive of the growths seen in mycosis fungoides.

Both of the cases of favus were of long standing and in foreigners; one of the patients being a German and the other a Russian Pole; both had this skin affection when admitted to the asylum, where they had been for a number of years. It speaks well for the care these patients received that there had never been another case contracted from them.

The above are the examples of true skin disease worthy of mention; the other cases of interest were among the degenerations.

All of the recent treatises on mental diseases devote considerable space to the so-called stigmata of degeneration.

The stigmata shown by the skin are either congenital defects

retract them sufficiently to remove the sternum and ribs. There were numerous nodules scattered throughout the tissues.

Thorax.—There were a number of nodules, varying in size from 1/10 to 1 inch in diameter, disseminated over both the visceral and parietal layers of the pleuræ and throughout the lung tissue. As the pathological changes of the other organs have no direct bearing on the case this part of the report will be omitted.

Microscopical examination of nodules taken from the skin, pleura and lung tissue show the neoplasm to be carcinoma.

or growths and changes that denote some degenerative process that would naturally occur late in life, due to the degenerations of senility.

The alienists classify under the cutaneous stigmata the following: Fibroma, angioma, ichthyosis, nævus unius lateralis, atrophia cutis, telangiectasis, hypertrichosis, pruritus, moles, keratosis pilaris, leucoderma, pigmentations, vascular nævus, and patches of grayness.

Of the one thousand and eighty-four cases examined, two hundred and ninety-six had one or more of these atrophic or hypertrophic dermatoses.

The most common degeneration was atrophia cutis of which there were eighty-nine cases. The degrees of atrophy varied from a mild keratosis to a marked general wasting of the skin. No case of atrophy in a patient over forty-five years of age was noted.

One severe example of universal cutaneous atrophy was seen in a girl only twenty-two years old.

In one terminal dement the skin of the trunk and limbs appeared perfectly normal, but that of the face was atrophied to a marked degree.

Ten patients—four epileptics, three paranoiacs, and three terminal dements—had those minute atrophic spots about the hair follicles which have been described by Browning (Journal of Nervous and Mental Diseases, September, 1896). From a study of these ten cases I am inclined to think that if they are not actually minute examples of atrophoderma striatum et maculatum, they are at least closely related thereto.

Hypertrichosis is a stigma upon which considerable stress is placed. All but eight of the cases here tabulated occurred in females. The eight men had thin and coarse beards, but their bodies were thickly covered with hair, especially marked over the spine. Twenty of the women had a copious growth of thick stiff hairs on their lips and chins. Most of the others had an unusually thick fuzz all over their faces; all of them, however, had an abnormal amount of coarse hair over their bodies, thickest on the chest and back.

One case illustrates how the mental condition seems to influence the growth of the hair; inasmuch as this appears to be unique, a full history will be given.

The subject was a German girl aged twenty-four. Late in 1900 she had been admitted to the asylum suffering from an attack of acute melancholia; after six months she was discharged. Dr. Warren, who had charge of her, stated that while she was profoundly melancholic there seemed to be an increased growth of hair all over the body, especially marked on the face. She was readmitted in January, 1902, suffering from a relapse. Examination at that time did not reveal anything especially abnormal regarding the hair, except, perhaps, that she was a little more hairy than most females of her age.

Her mental condition gradually grew worse until she went into profound melancholia. It was then noticed that the lanugo hairs all over the body were becoming thicker and stiffer. This change was most marked on the face, which rapidly became covered with a growth of fine blonde hairs, some being one-fourth to one-fifth of an inch in length. Her appearance at that time suggested a mild type of the " Russian dog-faced boy."

After three months her mental condition slowly improved; simultaneously the superfluous hairs began to drop out, and on August first her face and body were as free from hair as when I first saw her.

Telangiectasis, especially the papillary varices, is also recognized as a stigma.

At the beginning of the examinations I thought that this vascular defect certainly was more prevalent among the insane than in those having all their mental faculties. As the examination advanced it was found that this capillary condition was more prevalent among the males, only one-fourth of the tabulated cases being females.

This difference between the sexes is easily accounted for by the more severe manual labor of the males.

Wishing to positively determine if mentally sound men and women in a similar station of life were subject to this capillary degeneration, I had Dr. Woolsey examine a corresponding number of patients at the Kings County Hospital. Their ages, occupations, social condition and nationality were about the same as of the patients in the asylum. Out of the three hundred and fifty cases examined, he found the proportion—one-fourth females to three-fourths males—was about the same as in the State Hospitals.

Concluding from these observations, telangiectasis cannot be classed as a stigma, or even a condition at all dependent upon insanity. Anyone whose habits or occupations subject the capillaries to strain will be apt to have more or less of these vascular defects after middle life.

The fibromata were generally multiple, of the flat variety; only one instance of the pedunculated was seen. This point is emphasized because it is claimed that the pedunculated variety is the kind most frequently found in the insane.

One interesting case of fibroma was observed in a man who had a band of tumors, two by four inches in extent, situated in the left lumbar region; the growths were from a millet seed to a large pea in size, hard and firm to the touch, deeply situated in the skin. One of them was excised and examined microscopically; it appeared to be a simple fibroma.

In the case of nævus unius lateralis the wart-like growths were situated on the right arm and back; a line about an inch wide began about mid-way between the elbow and the axilla, extending upward and crossing the axilla, curved backward along the lower border of the scapula, covering in length about twelve inches.

Only four out of the fifteen cases of moles were of the hairy variety; two were placque-like; the rest were instances of the ordinary pigmented mole.

This point is mentioned because the hairy mole, especially occurring as a large patch, is claimed to be the most frequently found among the stigmata of degeneration.

The case of pigmented skin closely suggested the discoloration produced by chronic arsenical poisoning.

Besides the diseases and defects tabulated, there were two cases of othæmatoma; two of enlarged thyroid; one enlarged unilaterally; one of whitlow, and one peculiar instance of capillary dilatation; all of the cutaneous capillaries of the back were hypertrophied, giving the appearance of a fine network in the skin.

Two other patients had tubercular glands.

Many of the writers on insanity, especially the older ones, lay considerable stress upon the oily and greasy skins of the melancholiacs; they also speak of a characteristic odor of insan-

ity. Except in patients suffering from seborrhœa, I failed to see that the skin of the insane was any more oily than that of those who were not mentally affected. As for the disagreeable cutaneous exhalations, it is doubtful that anyone would be able to detect any unusual smell in our modern hospitals for the insane, except, perhaps, in the wards for epileptics and melancholiacs. The patients in these institutions are obliged to bathe at frequent intervals, and a careful surveillance is kept over their personal habits.

The *conclusions* of this paper might properly be introduced by the following questions:

Was not this examination a great amount of work for very little gain? And could not the results have been forecast from the beginning?

No systematic examination is ever worthless from a clinical standpoint; more especially is this true in a field that has not been previously covered.

Moreover, certain relatively positive results can be arrived at, for this examination has conclusively proven that the skin shows less tendency to disease when people are obliged to live regular and well ordered lives.

In over a thousand insane patients, nearly all of whom were from the lower walks of life, there were only one hundred and forty-six examples of pure skin disease, and some of this number were from external causes, or had been contracted before entering the institution.

It has also emphasized the fact that the insane are more subject to degenerative dermatoses than those mentally sound.

It is further evident that many of the statements of the alienists, so often quoted and reiterated, regarding the cutaneous stigmata, are entirely wrong, doubtless because founded on insufficient basis.

We need but to refer, as an example, to their remarks regarding telangiectasis and moles. Certainly their conclusions were not borne out by this investigation.

The statements regarding the distinctive odor of the insane should be eliminated from the text-books on insanity. When that could have been truthfully written, the public insane asylums were conducted upon an entirely different plan, and the dirty,

oily, ill-smelling patients were so because they were not cared for in the humane and hygienic manner in which they are at present.

In closing, I wish to express my appreciation of the courtesy shown me by Dr. Robert M. Elliott, Superintendent of the Long Island State Hospital.

I also wish to thank Drs. Tracy and Warren, and the Hospital Staff, for valuable assistance and data.

To my clinical assistant, Dr. William C. Woolsey, I am greatly indebted for his kindness in assisting at the examinations, and also for making the comparative investigations at the Kings County Hospital.

DERMATOSES OF THE INSANE—TABLE OF FINDINGS.—WINFIELD.

Number of Patients Examined: Females, 723; Males, 361; Total, 1,084.

Ages by Decades.	10-20,	20-30,	30-40,	40-50,	50-60,	60-70,	70-80,	80-90,	Unknown,	Total,
	9	137	279	240	214	127	29	5	34	1,084.

Nativity: U. S., 515; Ireland, 327; England, 41; Scotland, 14; Wales, 2; Germany, 115; Austria, 8; Italy, 4; France, 3; Spain, 2; Sweden, 17; Norway, 6; Denmark, 7; Russia, 7; Japan, 1; East Indies, 1; West Indies, 3; Poland, 4; Bohemia, 1; Hungary, 1; Switzerland, 1; Armenia, 1; Canada, 1; Unknown, 2. Total, 1,084.

	Negative.	Eczema.	Psoriasis.	Acne.	Acne Rosacea.	Scabies.	Seborrhœa.	Epithelioma.	Syphilis.	Chromophytosis.	Fibroma.	Eczema Seb.	Zoster.	Paget's Disease.	Sarcoma Cutis.	Dermatitis.	Favus.	Trichophytosis.	Angioma.	Keloid.	Verruca.	Ichthyosis.	Nævus Unius Lateralis.	Atrophia Cutis.	Telangiectasis.	Hypertrichosis.	Pruritus.	Moles.	Keratosis Pilaris.	Leucoderma.	Alopecia Areata.	Pigmentations.	Sebaceous Cyst.	Nævus Vasc.	Premature Grayness in Patches.	Total.
Terminal Dementia	294	6	....	13	5	1	9	2	3	6	10	....	2	....	....	7	..	1	1	2	1	3	1	29	27	36	7	5	6	1	1	1	....	1	1	502
Acute Melancholia	34	1	1	3	....	....	6	....	2	....	....	....	....	....	....	....	....	....	1	....	....	....	....	12	1	4	....	3	..	....	....	....	....	....	....	60
Chronic Melancholia	57	....	....	7	....	....	....	....	....	....	1	....	....	....	....	1	1	....	....	....	....	....	....	....	4	....	3	2	1	....	....	....	....	....	....	91
Acute Mania	15	....	....	..	....	....	....	....	2	1	..	....	....	....	....	....	1	1	....	....	....	....	....	....	1	1	....	....	....	....	....	....	3	....	....	27
Chronic Mania	83	....	....	2	....	....	3	1	....	4	2	....	....	....	....	....	....	....	....	....	....	....	....	17	5	5	....	....	1	....	....	....	....	....	1	130
Paranoia	60	3	1	3	1	....	3	....	....	1	3	....	....	....	....	....	....	....	1	1	1	....	....	11	4	8	....	....	....	1	....	1	....	1	....	104
Paresis	26	1	....	2	....	....	....	....	8	....	2	1	....	....	....	....	....	....	....	....	....	....	....	1	6	5	....	2	....	....	....	....	....	....	....	54
Epileptic Dementia	41	....	....	8	....	....	1	....	2	....	....	....	....	1	1	....	..	....	....	....	....	....	....	5	....	8	....	3	....	....	....	1	....	....	....	71
Imbecility	19	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	1	1	....	....	....	....	1	....	....	....	26
Primary Dementia	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	14
Secondary Dementia	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Recurrent Dementia	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Alcoholic Dementia	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Puerperal Dementia	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Circular Insanity	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Idiocy	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Unclassed	6	....	....	1	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	3	....	2	....	....	....	....	....	....	....	....	....	14
Total	665	11	2	39	6	1	24	3	17	14	19	1	2	1	1	9	2	2	3	3	2	3	1	89	59	78	11	15	8	2	1	4	5	2	2	1107

REPORT OF A CASE OF DEMENTIA PRÆCOX WITH AUTOPSY.

By WILLIAM RUSH DUNTON, Jr.,

Assistant Physician, Sheppard and Enoch Pratt Hospital, Towson, Md.

The following case is especially interesting owing to the fact that a careful pathological examination was possible. The patient was under observation for nearly four years and during that time showed symptoms of dementia præcox in a katatonic form. His death finally occurred from tuberculosis. In this connection it is to be noted that twenty-five years ago Kiernan[1] called attention to the fact that a great many cases of katatonia died of tuberculosis, and that tubercular meningitis was a frequent etiological factor. The results of the pathological examinations of the present case are somewhat disappointing if we expect any very decided cell alterations, but on the other hand, the positive findings are suggestive and seem to me to indicate the lines upon which further research can best be carried out for future study of this class of cases.

The patient was a young man of twenty-two years, a clerk, and was admitted to the Sheppard and Enoch Pratt Hospital, December 9, 1898.

Family History.—The patient's mother died of tuberculosis and his maternal grandmother of paralysis. His father, two brothers and four sisters are living and well.

Previous History.—A full account of the patient's early history could not be obtained. His habits were good, and he had been of a cheerful but reserved disposition. Six months before admission the patient fell from his bicycle and was in a dazed condition for a few minutes afterwards. This was the only fact obtained which had any possible bearing on his present illness.

[1] Kiernan, James G: Katatonia, Am. Jour. Insanity, vol. XXXIV, p. 59, 1877; Alienist and Neurologist, vol. III, p. 558, 1882; Detroit Lancet, Feb., 1894.

Present Illness.—The onset was sudden, having occurred on the morning of December 5, when the patient was confused, refused to go to work, and gave inadequate reasons for his behavior. The night before admission he had wandered away from home and some difficulty was encountered in inducing him to return. He refused to talk except in a loud monotonous tone. On the day of admission he had refused food. He had had insomnia, but had refused to take medicine, saying that the doctors would poison him.

On December 31, 1898, it is noted: "The patient's moods are variable. There are periods when he is quiet, orderly and rational, and eats and sleeps well. At other times he is irritable, sullen, noisy and untidy, and refuses food. Occasionally he sings hymns. He frequently removes his clothing and takes his ring from his finger, refusing to have them on, saying that they do not belong to him."

A month later stereotyped habits are noted, the patient doing everything in an automatic way and being confused if anything interfered with his usual routine, for example: his place at table being changed, he missed several meals rather than sit in a new place.

March 22, 1899, the patient was very demonstrative, screaming and shouting. He declared that he had been treated like a thief and murderer, that his mind was sound and always had been, that he never should have been placed in the hospital, and that some one should suffer for it.

In May, 1899, it was noted that a gradual change had taken place in his character. He had formerly been mischievous, profane, obscene, and a mimic. He now began to have periods of depression during which he sat for hours almost motionless. These periods alternated with outbreaks of excitement. He gradually became more and more untidy and filthy. His speech became very incoherent, and he often pronounced meaningless words of his own coining, such as, "we are all snuzzers, what is a snuzzer, I'm the smartest that ever wuzzer." These self-coined words he occasionally sang to hymn-tunes. When being fed he would repeat such phrases as "Give Watty some bread and butter." The patient had to be fed by a nurse and showed certain idiosyncrasies in his eating such as bolting his food, or trying to eat a slice of

bread by drawing it into his mouth with his lips and tongue without touching it with his hands. At times he was quite resistive and spat out whatever was placed in his mouth, or kept his lips tightly closed against any efforts to place food in his mouth. At other times he was quite passive, opening his mouth for the food and swallowing it without chewing. Later he had to be fed artificially. He had the habit of keeping saliva in his mouth and rolled it about with a gurgling sound by making puffing movements with his cheeks. Grandiose ideas were present. He several times said: "I am very wealthy, and when I once get away from here you will never see Watty again." Impulsive acts were very frequent. He would strike the nurses, kick the furniture, or suddenly jump from his chair and walk swiftly up and down the room. When being fed he would occasionally break the plates. He sang a great deal, was given to sudden outbursts of laughter, and frequently cursed himself and the nurses.

Following is the note of October 16, 1900: The patient sits in a chair with his eyes downcast and makes very few bodily movements, remaining in one position an indefinite time. When asked questions he does not raise his head, but occasionally turns it toward the speaker and smiles. At times he says a few words in a very low voice. He will not look at the speaker when asked to. When his gaze has been fixed in any one direction and an object is placed before his eyes so as to obstruct his vision, he does not change his position nor look away. When standing he will not look up but keeps his eyes fixed upon the floor. He will stand against the wall with his feet close together and his head thrown back in an uncomfortable position for a long time. There is a tendency on the part of the patient to allow his arms and head to remain in whatever position they may be placed even though it be an unnatural and uncomfortable one. There is no resistance to any passive movement, and no negativism. All voluntary muscular movements are slow. He will allow flies to crawl over his face without making any effort to brush them off. He winks easily if a quick movement is made towards his eyes. The patient is in a good humor and resents nothing that is done to him. He is fairly well nourished. His superficial circulation is very poor, the hands being cold and clammy and the finger nails blue. He breathes through his mouth. The pupils are even and equal,

neither contracted nor dilated. The consensual and direct light, and accommodative reflexes are present. The knee jerks are exaggerated. The pulse is about seventy-two and is very slightly irregular in rhythm.

The patient gradually became more demented and his habits more filthy. The impulsive acts became a more prominent symptom in the early part of 1901. Subsequently there was little change until February, 1902, when the patient developed a slight evening pyrexia, a cough without expectoration, and being rather weak was put to bed. Following are the notes of a physical examination made February 16, 1902:

Thorax.—The intercostal spaces are just visible on both sides, being more prominent on the left. There is visible sinking over the left apex as compared with the right, and respiratory movement is very much limited in this region. There is marked impairment of the percussion note over the left apex extending as far as the third rib in the para-sternal line and in the axilla down to a level with the nipple. In this region the breath sounds are much modified, expiration being somewhat prolonged, and towards its latter part one or two fine crackles are heard. When the patient coughs these are replaced by several fine, moist râles.

Heart.—Apex beat is visible and palpable in the fourth interspace barely outside of the nipple line. Pulsation is also prominent in the second and third interspace, from the sternal border to near the mammary line. Sounds are of fair relative intensity, no murmurs being heard. The second pulmonic sound is markedly accentuated, being sharp, loud and snapping, and showing a suggestion of reduplication. The aortic second sound is slightly diminished. The pulse is regular, of small volume and low tension, and has a rate of twenty-one to the quarter in dorsal decubitus. The finger nails are blue.

Reflexes.—Triceps, radial, and patellar reflexes are active. The abdominal and cremasteric only fairly so. Myoidema is present over the thorax, and the fibrebundles of the pectoralis contract promptly on percussion. There is no marked dermatographia.

The patient lies in bed taking little or no notice of his surroundings. He sometimes follows an object with his eyes, but sound stimuli make very little impression upon him and he does not answer when spoken to or asked questions. His skin feels hot to the touch.

The patient's physical symptoms gradually became more marked. About a month after the above examination an expectoration appeared in which tubercle bacilli were found. He died very quietly, April 6, 1902. For several weeks before his death the patient's temperature and pulse had been subject to considerable daily variation, the pulse being always above the normal and the temperature varying from subnormal to nearly 102° F. During the last weeks of the patient's life these variations became more marked. His respirations were never very high, averaging 25 to the minute until shortly before death, when they gradually rose to 34. His temperature had been 104° F. at 8 p. m. of the day before he died, and had fallen to 100° F. at midnight, and to 96° F. at 8 a. m., three hours and three-quarters before he died.

The autopsy notes are as follows: Autopsy eight hours after death.

General Appearance of the Cadaver.—The body is extremely emaciated. The abdomen is markedly scaphoid. Rigor mortis is just beginning. There is no post-mortem discoloration except a venous stasis of the dependent portions of the body. The pupils are moderately dilated and slightly irregular. The cornea are clouded, there is no local œdema. The tibial crests are clear. There are no genital scars. The testicles are small. There is an oval cicatrix on the inferior, interior aspect of the right knee about 2 x 5 cm., probably the result of a burn.

Head.—The cranial bones are thick and the dura is entirely free from the skull. A few normal adhesions are present along the medial line between the dura and the pia-arachnoid, especially over the upper end of the left pre-central convolution. There is a moderate amount of sub-pial œdema, the convolutions being thrust apart by the accumulation of fluid. The pia-arachnoid is not thick nor clouded, and is not adherent to the cortex. The cortex is everywhere firm and of an even consistency. The basal arteries are clear. In the right hemisphere the episylvian sulcus is markedly developed, being 2 cm. long extending upward and parallel with the fissure of Rolando. The para-central convolutions are noticeably narrow, the left being 1.5 cm., the right 2 cm. in antero-posterior diameter. The ventricles are dry.

Abdomen.—There is very slight subcutaneous fat, and the muscles are very thin. There is no fluid in the abdominal cavity.

The intestines are moderately distended with gas. On the intestines there are a few spots of hemorrhagic appearance, dark red in the centre with radiating capillary lines, the entire spot being 1 cm. in diameter. There is no other discoloration of the intestines, and no signs of tubercle. Between the layers of the peritoneum in the mesentery are many hard nodules, dark in color, and ranging from the size of a pea to a small marble. These are situated throughout the mesentery. The parietal peritoneum is normal.

Stomach.—The stomach is normal in size and in external appearance.

Appendix.—The appendix shows signs of an old inflammation, is red, enlarged, constricted and is bound by adhesions to the surrounding structures. The extremity lies 1 cm. over the brim of the pelvis, is freely movable and points towards the rectum.

Bladder.—The bladder is tightly contracted and contains no urine.

Prostate.—The prostate is difficult to palpate by rectum or from the inside and is evidently very small or atrophied.

Right Kidney.—The right kidney is normal in size, and its capsule strips off easily. On section the kidney is of a dark color and the vessels in the cortex are not sharply defined. It has a general appearance of cloudy swelling.

Left Kidney.—Similar to the right.

Liver.—The liver is not enlarged. There are no nodules, and no tubercular foci observed. Its color is a deep dark red. It has a general appearance of cloudy swelling. The gall bladder is not particularly full.

Pancreas.—Negative.

Spleen.—The spleen is slightly enlarged, is moist and juicy on section, but is firm to the touch. There is a small accessory spleen situated in the omentum.

Heart.—The pericardial cavity contains 50 cc. of clear yellow fluid. The heart is small, and there is some pericardial fat. The coronary vessels are not sclerotic. The heart muscle is normal in color. There are no signs of degenerated muscle macroscopically. The heart walls are thin. There is slight thickening of the mitral valve leaflets. The other valves are normal. There is a very slight beginning sclerotic appearance in the aorta.

Right Lung.—The upper lobe of the right lung is adherent at the apex and at the back. It contains a cavity 12 x 18 cm. partly filled with an anchovy-saucelike fluid. There is no functioning portion in this upper lobe, the part not occupied by the cavity being consolidated nor breaking down. The middle lobe is consolidated and studded with grayish-white patches averaging three millimetres in diameter. The lower lobe is crepitant but contains many patches similar to those above mentioned. There are pleural adhesions at the back and base.

Left Lung.—The left lung has many adhesions at the back and base. The upper lobe contains a large cavity 12 x 20 cm., the remainder of the lobe being consolidated or breaking down. The lower lobe is crepitant only at the margin, the remainder being consolidated.

For microscopic study of the central nervous system sections were taken from the frontal, temporal, para-central, Broca's, anterior and posterior central convolutions, the cuneus, hypophysis, angular gyrus, caudate and lenticular nuclei, facial area, cerebellum, lumbar and dorsal cord, and spinal ganglia. All portions of the cerebrum being from the left hemisphere. The hardening fluids used were formalin, alcohol, and nitric acid. Sections were stained by the Nissl, Bethe, Mallory, and Weigert-Pal methods, with Unna's polychrome methylene blue, and hæmatoxylin and eosin. Special study was made of the nerve cells and a summary of the results follows:

Frontal Convolutions.

A few of the larger cells show beginning pigmentation. Central chromolysis, or granular degeneration is usually present and in the periphery of the cell the chromatin is usually in masses. A number of cells are seen in different stages of disintegration. The cell processes are stained for a very short distance, but are usually distinct as far as they can be seen, and frequently show fracture lines.

There are dislocation, atrophy, and swelling of the nucleus. In a few cases the nucleus is crescent shaped. Folding of the nuclear membrane is very constant. The nuclear membrane is usually distinct, but is often irregular in outline. Neurophagocytosis is often seen, but there is no characteristic appearance as noted by

Alzheimer. Only occasionally are the cells not seen pointing towards the periphery.

The other layers of cells show similar changes. Neuroglia nuclei are most numerous in the inner layers. The nucleolus is more often centrally placed than peripherally in the third, fourth, fifth and sixth layers while the reverse is seen in the first and second layers. An endonucleolus is usually present. There is some infiltration about the capillaries.

Para-central.

The large Betz cells are not as much affected as the other cells but show an early central chromolysis (Plate XVI), and quite a variety of cell change, even to advanced disintegration (Plate XIV, Figs. 1, 2, 3 and 6). Massing of the chromatin is present and is very marked in a few cells with slightly stained achromatic substance. There is slight pigmentation. The Kernkappe is usually prominent, and an endonucleolus is usually present. The nucleus is usually atrophied in cells which are themselves atrophied. The fourth layer shows more disintegrating cells than the others. While neurophagocytosis is seen in all the layers it is most marked in the fifth and sixth. In the latter a cell with from three to five phagocytes in close proximity is frequently seen. The glia nuclei are not increased about the blood vessels.

First Temporal.

The large pyramidal cells show changes similar to those which have been noted. Their nuclei are usually irregular in outline and generally show atrophy. The cell processes are better seen than in other regions.

Neurophagocytosis is not so frequent as in the frontal region, but continues to be most marked in the sixth layer.

Fifth Temporal.

In this region the large nerve cells rarely show folding of the nuclear membrane, while it is very constantly observed in the smaller cells (Plate XIII, Fig. 3). Chromatin massing is constantly observed. The nuclear membrane is often difficult to make out. Partial extrusion of the nucleus is noted in one cell (Plate XIII, Fig. 2), while very near to it there is a perfectly normal cell. The glia nuclei are less often seen in close proximity to the cells.

Anterior and Posterior Central.

The large motor cells show beginning chromolysis and pigmentary change. The latter being usually apical. A few cells have darkly staining chromatin with more faintly staining achromatic substance. The cell processes are distinct. There is occasional dislocation of the nucleus and more frequent atrophy of the same (Plate XIII, Fig. 4.) An endonucleolus is commonly present. The small cells are similar to those already described, a nuclear fold being usually present. Neurophagocytosis is common. There is slight increase of neuroglia.

Cuneus.

The large cells show central chromolysis with chromatin massing. There is occasional dislocation of the nucleus. There are a few atrophied and disintegrating cells. The cell processes are not well stained. There are no blood vessel nor capillary changes.

Facial Area.

There is some central chromolysis present and the nuclear membrane is not well stained. The large motor cells show a slight beginning chromolysis, which is usually central, but is frequently quite marked at the base of the apical process, which latter is as a rule very indistinctly stained. The other cell processes are usually well stained. There is some cellular infiltration about the capillaries.

Broca's Region.

The large pyramidal cells show central chromolysis, folding of nuclear membrane, and an endonucleolus. The nuclear membrane is often indistinct, and the nucleus sometimes dislocated. A very few cells show an atrophied nucleus and pigmentation. There is the same arrangement of glia nuclei as has been noted in the frontal region, but it is not so frequent. There is only an occasional increase of glia nuclei about the blood vessels. The smaller cells show similar changes.

Angular Gyrus.

There is slight chromolysis and the nuclear fold is pretty constant. There is some grouping of the glia nuclei about the blood

vessels. There is a comparatively large opening in the central part of the section about which the glia nuclei are grouped.

Anterior Thalamus.

The cells show slight central chromolysis and occasional pigmentary change. Few disintegrating cells are seen.

Caudate Nucleus.

The large cells show extensive disintegration and central chromolysis. The pericellular spaces are increased and have many glia nuclei surrounding them.

The small cells show an occasional atrophied nucleus. The glia nuclei are increased about them and even encroach upon them. The perivascular spaces are increased in size. There is a greater increase of glia nuclei than in other regions and the glia nuclei are frequently arranged in rows. There is some cellular infiltration about the capillaries.

Tenticular Nucleus.

There is a slight pigmentary degeneration in the cells of this region beyond which there is no change which has not been already noted.

Lumbar Ganglion.

A number of cells of the lumbar ganglion show dark brown pigmentation, which differs from the yellow in occurring in larger granules corresponding in size with the chromatin granules. The position of the pigment is variable, sometimes occurring in the centre of the cell, sometimes nearer to the end or periphery. The nucleus is usually not affected. One small cell showed two nuclei. The nuclei are round, centrally placed and generally contain an endonucleolus. Some cells show a paler area which seems to be an early pale yellow pigmentation. The chromatin bodies are generally arranged concentrically. There is an apparent increase of glia nuclei.

Lumbar Cord.

The anterior horn cells show central chromolysis, an occasional slight pigmentation, dislocation of the nucleus, with frequent atrophy of the same, and usually contain an endonucleolus.

The Clarke's column cells are atrophied and have broken processes.

Cervical ganglion negative.

Cervical Cord.

The anterior horn cells show alterations in the shape of the nucleus. Very rarely they show pigmentation. The cell processes are distinct. There is some increase of glia nuclei about the blood vessels, and a slight glia proliferation about the central canal.

Cerebellum.

The Purkinje cells are rather irregular in shape. Some show a central chromolysis, particularly those at the apex of the convolutions. The processes are not stained. The nuclei are occasionally atrophied. One cell showed neurophagocytosis. Some cells are disintegrating.

The sections stained by the Weigert-Pal method showed that the tangential and other fibres were normal in all the regions examined. The tangential fibres showed beading, however, quite markedly. I do not attach much importance to this condition as it seems to me to be due to a post-mortem change or to be the result of imperfect fixation of the issue.

Hypophysis.—The hypophysis was apparently larger than usual, but was found to be histologically normal on microscopic examination. There was no increase either in the glandular portion or in the connective tissue.

Gasserian Ganglion.—Sections stained with the Nissl and polychrome blue methods showed most of the cells to be normal. A very few cells showed beginning chromolysis, and a still smaller number contained dark brown pigment granules.

Dura.—A series of horizontal sections were made of the dura as well as a number of vertical sections, and were all stained with hæmatoxylin and eosin. Microscopical examination showed them to be normal.

Lung.—Sections stained for tubercle bacilli showed them to be present, while hæmatoxylin and eosin sections showed a caseous and tuberculous pneumonia.

Liver.—Showed miliary tuberculosis with fatty degeneration.

Spleen.—Showed acute splenic tumor.

Kidney.—Showed slight dilatation of the vessels.

Aorta, pancreas, and *accessory spleen* were negative upon examination.

A summary of the microscopical findings of the brain is as follows: There is but slight cell change and this is distributed over the whole brain, not being restricted to any one area. The greatest amount of cell change is found in the first frontal convolution. The cells show central chromolysis; an occasional slight degree of pale yellow pigmentation; slight cell atrophy; atrophy, dislocation, and swelling of the nucleus; folding of the nuclear membrane; and an endonucleolus. As a rule the deeper layers are most affected. The motor cells show very slight changes similar to the above. There is a slight increase of neuroglia nuclei. Phagocytosis is well marked and there is considerable cell disintegration. There is no change in the medullated fibres, and no marked vascular changes.

In reference to the patient's death having occurred from tuberculosis and its possible influence upon the nerve cells, it is to be noted that the cell shrinkage which has been found to occur in tuberculosis[2] was not present. On the other hand the findings of this case are very similar to those of Alzheimer, quoted by Kraepelin,[3] who studied the brains of a number of cases who had presented the clinical picture of katatonia and who collapsed in what appeared to be acute delirium. In these cases Alzheimer noted swollen nuclei, wrinkling of the nuclear membrane, a shrunken cell body showing evidence of degeneration and a peculiar arrangement of the glia about the cell. This last was found in but one instance in the present case. Alzheimer's cases apparently ran a more acute course than did the case here reported, which may perhaps account for certain differences observed.

It is interesting to compare the microscopical findings of the present case with those of Kiernan's, published twenty-five years ago. He says: "There is a marked increase of the nuclei of the neuroglia. The ganglion cells, both pyramidal and fusiform, were normally contoured, processes well developed; protoplasm healthy, in some cases diffusely pigmented, and nucleus round and clear.

[2] A. Hoch: Am. Jour. Insanity, vol. LV, p. 231.
[3] Kraepelin: Psychiatrie, VI. Aufl., II Band, p. 181.

Free lymphoid bodies were accumulated in the pericellular spaces."

In the case here reported there was an undoubted increase of the glia nuclei and this increase was most marked about the nerve cells. Weber [4] has noted in a patient who died after a severe attack of epilepsy that there was an increase of cells which seemed to be new glia nuclei, about the vessels and nerve cells.

While I do not think that any inferences can be drawn from these findings at the present time, I am of the opinion that they are suggestive and may prove of value in later work.

DESCRIPTION OF PLATES.

PLATE XIII.

Fig. 1.—Purkinje cell showing what was first thought to be phagocytosis, but afterwards this seemed to be vacuolation.

Fig. 2.—Cell from fifth temporal convolution showing central chromolysis, swelling and partial extrusion of the nucleus.

Fig. 3.—Large Betz cell from para-central convolution, showing unusual form of folding of the nuclear membrane. Slight central chromolysis is also present.

Fig. 4.—Do. from anterior central convolution showing atrophy and dislocation of the nucleus and slight central chromolysis. This cell suggests a whirlpool cell.

PLATE XIV.

Figs. 1, 2, 3 and 6.—Cells from para-central region showing different stages of disintegration.

Fig. 4.—Cell from fifth temporal convolution showing disintegration.

Fig. 5.—Cell from anterior thalamic region showing marked disintegration.

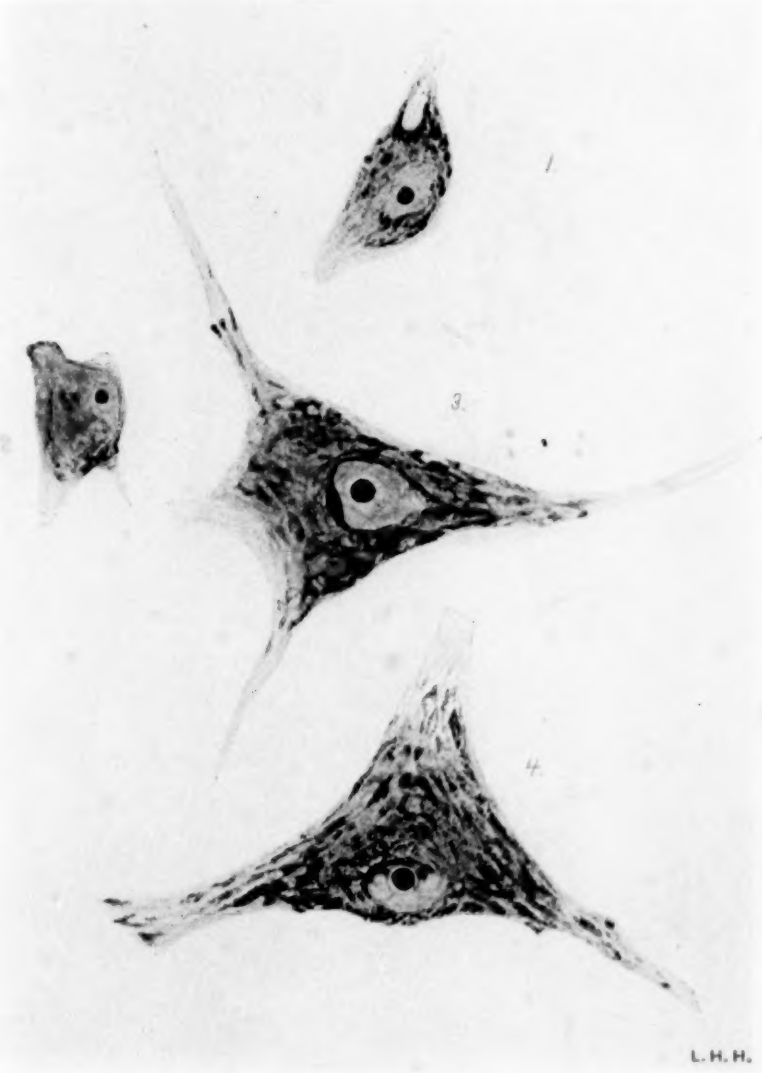
PLATE XV.

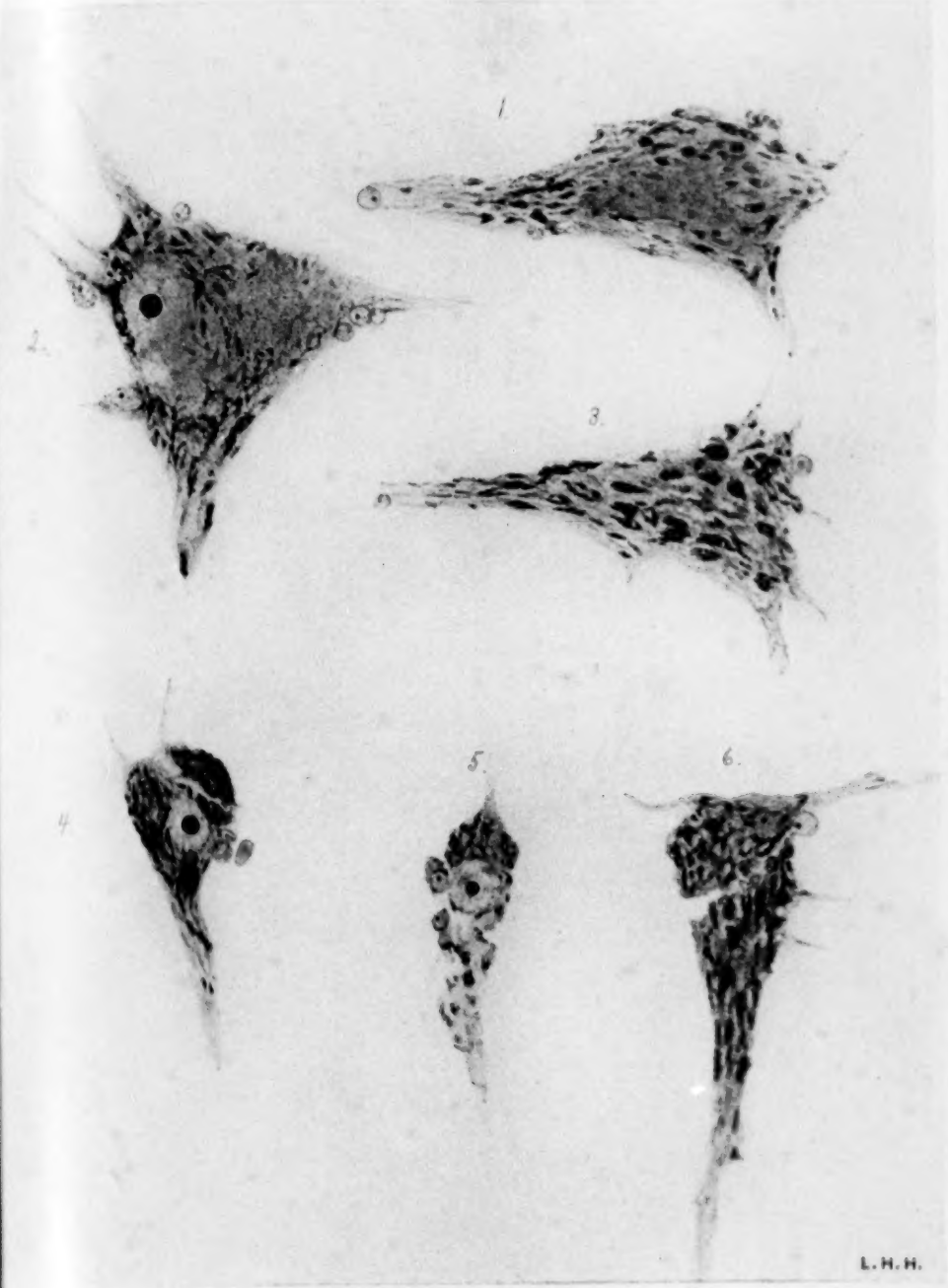
Showing glia nuclei about blood vessel, in cerebral cortex. There were very few vessels which had glia nuclei in greater numbers about them. The majority showed a still smaller number.

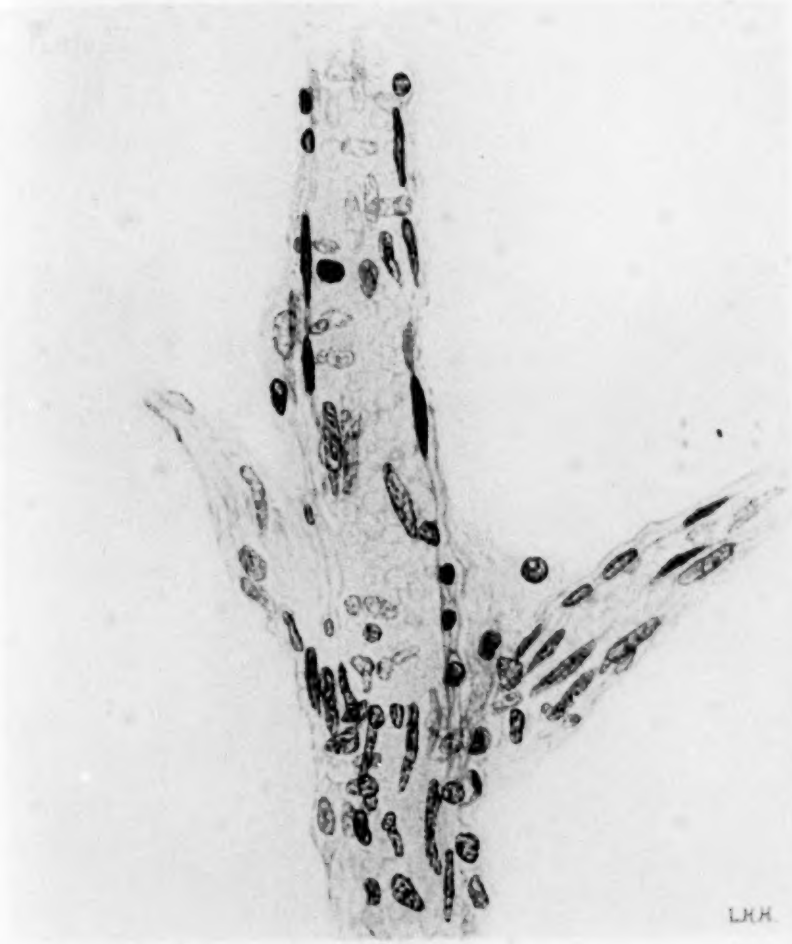
PLATE XVI.

Cells from para-central region showing chromolysis, atrophy and dislocation of the nucleus, and arrangement of glia nuclei.

[4] Weber: Beiträge zur pathogen. u. path. Anat. der Epilepsie, Jena, 1901.


1
3
4
L. H. H.


1.
2.
3.
4.
5.
6.
L. H. H.



L.H.H.

A CASE OF ABSCESS DIAGNOSED AS BRAIN TUMOR.[1]

By HERMON C. GORDINIER, M. D.,
Troy, N. Y.

The case to which your attention is directed is of interest because of the apparent sudden onset of the convulsions; their strictly localizable character; the entire absence of febrile reaction, save just before death, optic neuritis or other symptoms of cerebral compression; together with the absence, in the history, of injury, middle ear or antrum disease, or suppurating foci, the result of local or general infection.

The case was diagnosed as one of tumor of the right motor area lying upon or just beneath the cortex.

J. E. H. Aged 52, married. Farmer by occupation, entered the Samaritan Hospital, February 17, 1900, under the care of Dr. E. D. Ferguson, who kindly asked me to see the case in reference to the possibility of an operation. His father died from rheumatism. Mother is living but is rheumatic. One brother is living and is well. No history of cancer, tuberculosis, insanity, or nervous disease in family. Patient had had the usual diseases of childhood. During the past two years has had several attacks of indigestion. Denies venereal disease of any sort. Present illness began suddenly January 5, 1900, with a severe unilateral convulsion, followed by unconsciousness. The attack began with convulsive movements of the head and eyes toward the left side, then the whole body became convulsed and the patient lost consciousness. The effects of this attack passed away in a short time and none other occurred until January 31, 1900, the patient appearing perfectly well during the interim. On the before-mentioned date the second attack occurred very similar in character to the previous one. Neither

[1] Read at the 19th Annual Meeting of the N. Y. State Medical Association, October, 1902.

this nor the first attack was preceded by numbness. The second attack began with convulsive movements of the head and neck towards the left and almost simultaneously the arm and lower facial muscles of the same side were convulsed. This attack was not followed by loss of consciousness. A half hour later a third attack began identical in character with the preceding one and without loss of consciousness. On February 14, the fourth convulsive paroxysm occurred, milder in character than the former, accompanied by movements of the muscles of the head, neck, arm and face of the left side and without loss of intelligence. None of these paroxysms have been preceded by numbness or other sensory disturbances. After the last attack the patient noticed that the movements of his arm were awkward and very weak. A gradual failure of memory has accompanied these attacks, particularly for names and dates. He has never experienced severe headaches; he complains of a constant dull frontal headache. He has noticed no loss of vision. He never vomits; bowels constipated; urinates frequently at night; perfect control of bladder and rectum.

February 17, 1900, *Status Presens.*—He is moderately well built; height, 5 feet 10 inches; weight, 160 pounds; healthy; musculature flabby; no cyanosis. Respiration 16. Pulse 80, regular, full and of fair tension. Veins over the right side of scalp are prominent. Movements of eyeballs and eyelids are normal. Pupils are midwide and react to light and accommodation. No contraction of the visual fields; vision normal; optic discs normal; no defect of hearing; slight facial paralysis of central type, as evidenced by obliteration of the left naso-labial fold and dropping of the angle of the mouth on the same side; no *rigidity* of neck; tongue protruded straight, no atrophy nor fibrillary twitchings of same. Left arm is held in a position of semi-flexion and partially paralyzed. A slight contracture of the flexor muscles which is easily overcome is noticed. All the movements of the left leg are normal.

Reflexes in triceps tendons present on left side. No wrist tendon reflex or clonus on same side. Umbilical and epigastric reflex slightly exaggerated on left side. Cremasteric present but not as active as on right side. Left patellar reflex exaggerated and marked ankle clonic exists (same side). Babinski phenome-

non present. All reflexes normal on right side. *Sensations. Tactile painful* and *temperature* sense everywhere normal. Slightly impaired muscular sense in fingers of left hand. Patient is able to recognize at once all objects handled.

Cerebration decidedly slower than normal. When a question is asked, some time elapses before his answer comes. He often errs in names and dates. No aphasic symptoms were present, the patient being right-handed; no difficulty in writing. No unilateral convulsive seizures have occurred since patient has entered hospital.

Physical examination of internal organs negative. Urine 1020, acid. No albumin, sugar, pus, blood or casts.

February 22, 1900. Patient was anæsthetized and the right Rolandic area was exposed after the method of Reid. No pulsation of the brain was noticed beneath the opening. Dura was incised and vessels of pia were found injected. No tumor was detected. The opening was then enlarged by a *rongeur* forceps more especially forward, but despite the large opening nothing was found save a circumscribed area which did not pulsate. This area was explored with fine needles, but meeting no particular resistance it was concluded that the lesion was subcortical and inoperable. The wound was then closed. No hernia cerebri followed. The following day a careful examination was made and his condition was the same as before the operation. The optic discs were normal. He complained of no headache after the operation. A few days later it was noticed that the left arm was almost totally paralyzed. No sensory disturbances were present. No special change occurred in his general condition after the operation until March 12, when he became quite delirious, lapsed into an unconscious state in which he died on the following day.

THE EXAMINATION OF THE BRAIN.

Post-mortem was confined to an examination of the brain. On right side of scalp a large horseshoe-shaped cicatrix exists, not perfectly healed with the drainage opening at its most dependent part. The scalp is firmly adherent to the defect in the bony tables of the skull. Healing is well advanced and no pus is found. The defect in the skull begins 2½ cm. below the sagittal suture and measures 4½ by 3½ cm.

The crucial incision through the dura is united and no hernia cerebri exists. The brain is normal in size and shape and the membranes are free, save beneath the defect in the skull where they are intimately blended, and the dura is adherent to the edges of the overlying bone defect. There is a slight increase of the cerebrospinal fluid. The right cerebral hemisphere presents a prominence in the region of the central convolutions especially in their upper half. Over this area exists a local collection of sub-arachnoidean fluid confined by delicate adhesions in the meshes of the pia arachnoid. After removal of the pia arachnoid there was found a tumor-like projection which involved the middle third of the anterior central or ascending frontal convolution and extending forward and upward involved the bases of the superior and middle frontal gyri. This mass produced an evident bulging of the cerebral cortex, arising probably from the centrum semi-ovale, being covered only by a thin shell of cortical tissue a centimeter in thickness. The mass had an elastic feel as if it contained fluid; it measured 4 cm. in its antero-posterior diameter and 3½ cm. in its vertical diameter.

The exact location of the mass, well shown by the accompanying photograph, is just beneath the cortex of the middle third of the ascending frontal gyrus, whence it extends forward and upward across the precentral sulcus involving the bases of the first and second frontal convolutions which gyri are pushed forward by it.

The ascending frontal convolution is, from below upward, distinctly widened. The cortical portion of the posterior central gyrus is not involved, but the fissure of Rolando in its upper part is narrowed. The superior portion of the ascending frontal, the paracentral lobule, the marginal portion of the superior frontal gyrus, as well as the outer and median surfaces of the superior parietal convolutions are normal.

The right hemisphere was sectioned after the method of Pitres and an abscess was discovered surrounded by a distinct capsule about ½ cm. in thickness. The abscess is entirely subcortical and measures, in its antero-posterior diameter, 5 cm.; in its vertical, 2½ cm.; and in its broadest part, 3¼ cm. The abscess cavity extends forward into the frontal lobe involving the centrum ovale just beneath the cortex of the bases of the

superior and middle frontal convolutions. It then broadens out beneath the anterior central convolutions, where it has its greatest development. The superior wall of the capsule is covered by a thin shell of cortex, half a centimeter in thickness. The abscess proceeds backward, diminishing in size and depth, and beneath the cortex of the middle third of the posterior central convolution it terminates. An area of softening exists in the centrum semi-ovale, at the junction of the ventral portions of the superior and inferior parietal lobules.

The pus in the abscess cavity was thick and contained much broken-down brain tissue. Coverslips taken from it, showed a rod-shaped organism, resembling one of the "colon" group, which completely decolorized with Gram's method. The identity of this organism could not be determined, as the brain was sectioned after several months of hardening in "formol" solution. The surrounding brain tissue showed only inflammatory changes, evidenced by the presence of numerous dilated vessels, with much small round-celled infiltration, especially in and about the perivascular spaces. The neuroglia elements were not proliferated.

It is to be regretted that, in this case, a complete autopsy could not have been made, as it, doubtless, would have cleared up the unsolved problem, i. e. the causation of this abscess.

The following conclusions may be drawn from a careful study of this interesting case:

1. First and foremost the necessity of an exploratory puncture or incision in every apparently inoperable brain case where the symptoms are strictly localizable, regardless of the supposed pathological lesion.

2. This case confirms the opinion expressed by the author in an article published in the Albany Annals, of October, 1898, on the diagnosis of lesions of the centrum semi-ovale with a report of a tumor in that region; namely, that typical Jacksonian epilepsy may be excited as well by a lesion in the white matter beneath the motor cortex as by one upon it.

3. The ataxia of the arm in this case may be explained in two ways, either by the involvement of the sensory fibers in the white matter of the inferior parietal lobule, as both Prof. Starr and Von Monakow have observed cases of loss of the muscular sense

due to lesions in this area, or by destruction of a part of the fibers of the fronto-cerebellar tract.

4. It is interesting to note in this case that no disturbances of general sensations other than ataxia in the arm were observed and that the Jacksonian attacks were not preceded by the usual signal symptom of numbness in the parts convulsed, even though the lesion was located in the white matter of the sensori-motor area. Why this was so is difficult of explanation. It is possible that the lesion was at first of such a character that the sensory fibers were gradually displaced, before being destroyed, allowing the establishment of compensatory channels for the conduction of sensory impulses, owing to the great tangle of sensory fibers in and just beneath the cortex.

5. The paresis of the left arm which followed the local convulsive seizures was due both to compression and destruction of the motor fibers of the arm area by the lesion.

6. It is noteworthy that with an abscess of such dimensions as the one observed in this case, at no time did symptoms of compression exist, manifested throughout by the absence of optic neuritis, drowsiness, coma, or slow respiration and pulse-rate, and while the presence of such symptoms are of great value in the diagnosis of brain tumor or abscess, their absence does not negative such a diagnosis. Another interesting fact connected with the clinical course of this case was the almost complete absence of fever until the day before death.

7. This case beautifully confirms the value of local convulsive movements in diagnosing local brain disease. It also confirms the position of the centers for conjugate movements of the head and eyes as well as those for the movements of the arm. It proves, furthermore, that these local convulsive seizures may be excited as well by a lesion in the white matter, just beneath the cortex, as by one upon it. It proves further that the true motor area is located ventral to the fissure of Rolando, as many experimental physiologists have believed.

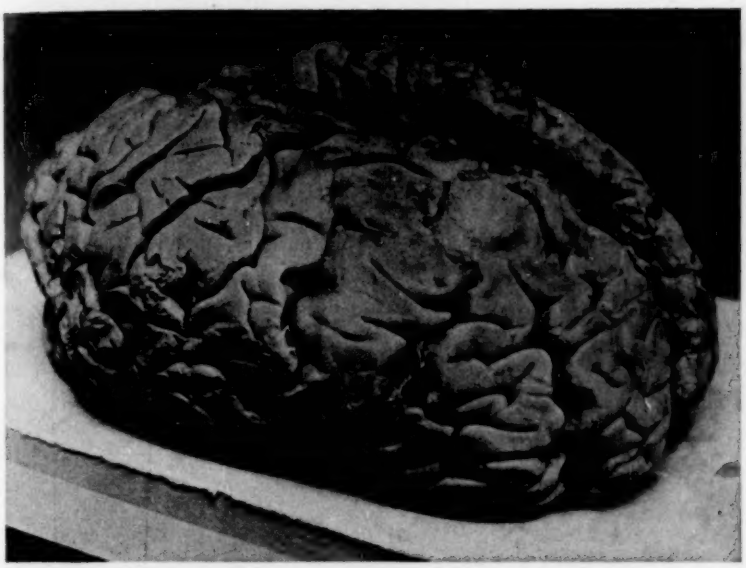


FIG. 1.

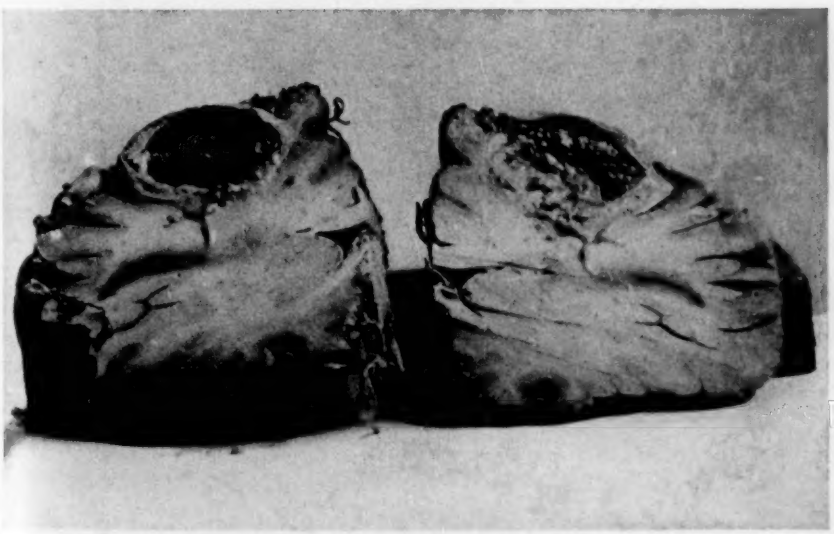


FIG. 2.

A CASE OF BRAIN TUMOR IN A WOMAN SEVENTY-EIGHT YEARS OF AGE.

By J. D. MADISON, M. D., of Hathorne, Mass.,
Assistant Physician, Danvers Insane Hospital.

The following case seems worthy of record on account of the rarity of brain tumor in extreme old age:

Sarah F., aged 78 years, was admitted to the Danvers Insane Hospital September 18, 1901. The following history of the case was obtained from the family:

Family History.—A nephew was insane for some time but recovered. A cousin died of cancer of the breast, and a daughter of pulmonary tuberculosis.

Personal History.—Nothing known about diseases of childhood. Patient had always been a strong healthy woman, and was not known to have had any serious illness. During most of her life, she was a hard worker. She never used liquors of any kind, and there was no history suggestive of syphilis.

Present Illness.—Three or four years ago, the patient first began to have severe headaches in the occipital region, which were described as neuralgic pains. They usually troubled her more during the night than during the day and did not prevent her from doing her work. So far as could be ascertained, these pains were always occipital. They had not been complained of during the eight months preceding her admission to the hospital. Beginning about two years ago, it was noticed, on several occasions, that her gait was a little unsteady, and her daughter had seen her sway as though she were going to fall backwards. She was not known to have complained of dizziness, and no history could be obtained of nausea, vomiting or deafness. Her vision was not thought to be affected, but it was remembered that shortly before coming to the hospital, she had one day looked at her cane and said, "Well, don't that

look queer," as though it might have appeared double or crooked. About this time it was noticed that her left eyelid was beginning to droop. The family had no definite recollection of any such event, but their physician had told them that the drooping of the eyelid was due to some kind of a shock. About three years before admission, the patient was supposed to have injured her right knee by a fall, and after that time had always used a cane. The family did not recognize that she was paralyzed in any way. The first mental change was thought to have come on about two months before admission to the hospital; it was noticed that her memory was impaired, though it had been considered good up to about that time. She was quite irritable and restless. She was heard to repeat words and sentences, and frequently called things by their wrong names; for instance, a bicycle she spoke of as an umbrella. Her speech grew thick, and she would often try to say something and failing would end with " Well, you know." Several times she wandered away from home and got lost.

Physical Examination.—The examination was not very satisfactory on account of the restlessness of the patient. She was a well nourished woman; weight 179 lbs. Hair nearly white. Irides blue. Pupils equal, and moderately dilated. Reaction to light and accommodation sluggish. There was well marked external strabismus of the left eye. The upper lid distinctly drooped. No paralysis of the facial muscles. The tongue was red, slightly coated; protruded straight. Teeth all gone. *Chest* large, and distinctly barrel-shaped. Breath sounds well heard; no râles. *Heart* somewhat enlarged. Action somewhat irregular. No murmurs heard. The second aortic sound was accentuated. Pulse 80 to the minute; slightly irregular in force and rhythm. Volume good; tension high. Artery wall distinctly palpable. *Abdomen* full and protruding. Atrophic scars over the lower portion. Liver dullness not increased. Percussion note tympanitic throughout. Lymphatic glands not enlarged.

Extremities.—The left patellar reflex was about normal; the right was slightly exaggerated. The right leg was not used as well as the left. Only a slight difference could be made out in the hand grasps, though the right seemed slightly weaker than it should have been.

Mental Examination.—The patient was restless, cross and irritable. She was not oriented as to time and place, and spoke of having been recently married, which was not correct. She has had several children, but was unable to give their names, and evaded the question by saying that they had different names. Could not tell what she had had for breakfast. When asked who was the President, she replied "The man is dead, and I suppose he is buried before this time." She understood quite well simple questions addressed to her, though the more difficult ones she did not seem to comprehend. Large print was read quite well. She was unable to name most of the articles shown to her. A watch she called "A regular piece"; keys, "A town is obliged to keep them"; knife, "It's a good nice ave"; purse, "It's got money in it." Pieces of money were recognized. Pillow, "It's kind of nice looking"; tape measure, "Very good looking"; towel, "It's some kind of a thing"; cross, "It looks like a very good watch"; glasses, "They want to see everything." She called her mouth an eye. She frequently used the wrong word; as, "Now let me have my dishes" (clothes); "Let me come" (go). She was able to pronounce words well, and usually recognized the names of objects when they were told her.

She wrote her name correctly, but when given a sentence to write, she readily forgot it, and wrote the first part over several times. She wrote *tod* for *God*, and *gave* for *save*. The spelling was not correct. The following are the chief facts in her subsequent history.

Headaches.—She did not complain of headaches at first, but after a time they appeared to distress her, being apparently frontal in character. It was difficult to judge of their severity on account of the patient's inability to express herself. She would at times point to her forehead and say, "Here mister, bad, bad." The headaches were frequently present in the morning, and on these mornings, she was more helpless getting dressed. At times they were pretty continuous, and seemed to grow somewhat worse toward the last.

Dizziness.—There was no evidence that the patient experienced dizziness during the first month of her stay in the hospital. One day out in the yard, it was noticed that she could not stand,

and she was evidently suffering from dizziness. After this occurrence, this symptom was frequently noticed in the morning. At these times, she needed more assistance in dressing, and could not stand well alone. For the last few days before going to bed, she could not stand at all, and would fall whenever she tried to get out of her chair, which she frequently did.

Vomiting.—The patient vomited one morning a few days before taking to her bed, but this was the only time she was known to do so. She frequently ate almost nothing at breakfast, and when urged would often reply, "I can't, mister." She may have been suffering from nausea.

Aphasia.—The aphasic condition seemed to remain about the same up to about three weeks before she became bed-ridden. She then gradually began to talk much more poorly, and finally could say only "well" and "yes." She frequently used such expressions as "Look out for my potatoes," referring to her feet, and when her boots were taken from her, she often said she wanted her own "brothers." The patient continued up and about the ward until November 20, when she was put to bed on account of her feeble condition. She had always favored the right leg in walking, and the right patellar reflex had continued more lively than the left. Seven days later, she experienced some sort of a seizure, and was found in a very stupid condition. The right eye was closed as well as the left. She could not use either side of the body, and was never able to use the right side at all after that time, though she recovered the use of her right eyelid and left extremities somewhat. After this seizure, the patient was not able to talk at all. She continued in a very feeble, semi-comatose condition, and gradually sank and died on December 18.

Abstract of Protocol.—The organs of the thorax and abdomen presented the usual senile conditions. *Brain.*—The cranium and dura did not present any abnormalities. The pia-arachnoid was somewhat cloudy and edematous, but separated readily from the brain. The brain was placed immediately in formalin, and allowed to harden. The following is a description of the hardened specimen. The left temporal lobe is distinctly larger than the right. The tumor is readily seen on the ventral surface, but does not appear on the lateral or dorsal surface. On examining

the Sylvian fissure, the new growth is seen to extend across and involve the adjacent portion of the frontal lobe. Through this mass, in the Sylvian fissure, the left middle cerebral artery runs. The growth extends inward almost to the median line. A rounded nodule, a little larger than a hickory nut, is situated upon the left crus cerebri, involving the third nerve and the posterior cerebral artery. The greater portion of the nodule is within the Circle of Willis. This nodule can be seen in Fig. 2. The surface of the tumor has an eroded appearance, and is of a dirty gray color. On section, the tumor is found to involve a good portion of the frontal as well as the temporal lobe. The greater part of the involved portion of the frontal lobe is taken up by a crescentic or dome-shaped cyst, whose lateral, anteroposterior and dorsoventral diameters are 3.75, 3.75 and 1.75 cm., respectively. This cyst is well shown in Fig. 1. The cyst contained a straw-colored fluid, which was evacuated at the time of autopsy. Its walls are somewhat folded. On the ventral surface, it is separated from the surface of the brain by a very thin layer of tissue. On the median side, just outside the wall of the cyst, is seen the tip of the lateral ventricle represented by only a small slit (see Fig. 1). The new growth is seen on the ventral surface of the cyst, extending to within 1 cm. of its anterior tip. This is well shown in Fig. 1. From here it is continuous with the major portion of the tumor in the temporal lobe, where it extends posteriorly nearly to the end of the Sylvian fissure. The growth involves a large portion of the temporal lobe, but comes to the surface only ventrally. It extends to the basal ganglia, but only slightly involves the lenticular nucleus. The dimensions of the tumor are as follows:

Greatest lateral diameter, 6 cm.
Greatest dorsoventral diameter, 4 cm.
Greatest anteroposterior diameter, 9 cm.

About the middle of the tumor, several small cysts are seen, varying in size from the head of a pin to a small pea. They are readily seen in Fig. 2. About these cysts the tissue is friable and crumbles easily. In the posterior portion of the growth, there has been marked myxomatous degeneration, and quite large areas are soft and gelatinous. The greater portion of

the tumor is quite firm, especially the growing portion. The cut surface is, for the most part, of a dirty gray color, but in places is almost white or yellowish white. There are a good many hemorrhagic streaks but none of any considerable extent. The outline of the tumor is irregular, but not everywhere distinct, and in places shades off imperceptibly into the normal brain tissue. In the tip of the right temporal lobe, there is a second tumor, 8 x 8 x 14 mm. It is cylindrical in shape, of a dirty gray color, and quite well marked off from the surrounding tissue. This growth is shown indistinctly in Fig. 1, in the tip of the right temporal lobe.

Cerebral Softening.—Macroscopically, the softening seems to be confined entirely to the white matter, and is most perceptible in the larger tracts. It extends well into both the frontal and occipital lobes, and is a little more marked on the left than on the right side. There is no appreciable softening immediately about the tumor. No softening is apparent in the cerebellum. The softening can be seen in both Figs. 1 and 2. *Arteries.*—The walls of all the arteries are stiff and atheromatous. The lumen of the left middle cerebral artery is distinctly narrowed, but not occluded at the point where it passes through the new growth.

Microscopic Examination.—The sections were stained in hematoxylin and eosin and Van Gieson's stain. The growing portions of the tumor are quite cellular as a whole, but there are a number of areas of partial or complete necrosis. The tumor is quite vascular and many of the vessels, especially the smaller ones, are completely occluded. There have been some small hemorrhages. In the cellular areas, the nuclei vary much in size, and present a great variety of forms. They stain fairly well, but irregularly. A few very large cells are seen, and some of these present very irregular polymorphous nuclei. The growth shows a marked tendency to follow the sheaths of the vessels, and here it resembles closely a spindle-celled sarcoma. Sections from the area of small cysts are almost entirely necrotic; almost none of the nuclei stain. The tissue presents a honeycombed appearance, made up of large and small irregular cavities, containing detritus. The remains of very definite spider cells are seen, the long fibrillæ being very distinct, and in places producing a fine network. The remains of vessels are quite

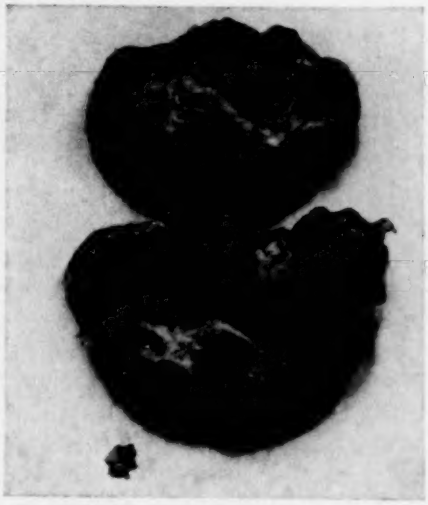


FIG. 1—Upper Section: Large cyst in frontal lobe with new growth on its ventral surface. Lower Section: Main tumor in left temporal lobe; also tip of right temporal lobe containing the small tumor; softening in the central white matter.

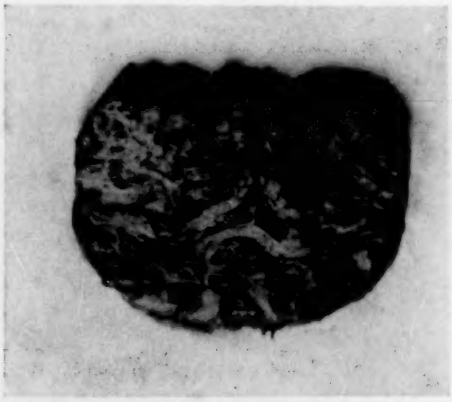


FIG. 2—Section reversed. Shows portion of tumor containing the small cysts. nodule on left crus cerebri and softening in central white matter.

numerous. In the sections from the posterior part of the tumor, showing a gelatinous appearance, the same necrotic condition is present, but perhaps in a more advanced stage. The cavities are larger and contain a semi-solid detritus. The large cyst in the frontal lobe has no definite lining membrane, but there is a considerable layer of gliomatous tissue about it, presenting much the same appearance as that seen in the cellular portion of the tumor. The tumor, as a whole, may properly be described as a gliosarcoma.

Tumor in the Right Temporal Lobe.—The growth is fairly well defined from the surrounding tissue. It is quite cellular, and contains numbers of ganglionic cells, having nuclei which stain faintly and irregularly. Many of these nuclei present the most varied forms. It is doubtful if any are actually multinuclear, as a narrow cord can usually be seen connecting the nodules of the nucleus when examined with the oil-immersion lens. One cell is seen showing a karyokinetic figure. This tumor is a glioma.

Arteries of the Brain.—The walls of all the larger arteries show marked degenerative changes. The intima in most is irregularly thickened, though with the exception of that of the left middle cerebral artery, the lumen is nowhere very markedly narrowed. Along some of the vessels the new growth has extended to a considerable distance. The left middle cerebral artery is very intimately involved in the growth, and the lumen of this portion of the artery is very distinctly narrowed, though nowhere completely occluded. The narrowing seems to have been largely due to the irregular thickening of the intima. At one point, the lumen of the vessel contains a small nodule of the new growth.

Cerebral Softening.—Sections from the white matter of the brain show very marked evidence of degeneration and necrosis. The changes are not nearly so intense in the gray matter, but in most places they are quite distinct. Many of the nerve cells are shrunken, and show an increased amount of pigment. In many, the nuclei are swollen, while some show evidences of fatty degeneration. No evidences of softening are apparent in the cerebellum.

Brain tumor in old age is a very rare condition. In 1886,

Hale White (Guy's Hosp. Reports, 1886, Vol. 28, p. 117), reported 100 instances of brain tumor, which represented the total number of cases to be found in the records of Guy's Hospital. Only two of these patients had lived to be above 70 years of age. One was a man aged 77; the other a woman aged 86. Mills and Lloyd (Pepper's System Med., 1886, Vol. 5, p. 1028) out of 100 collected cases, report only one over 70 years of age. This was a woman aged 73. There was also a small glioma in the tip of the right temporal lobe. Multiple tumors of the brain are not especially uncommon.

The case is also interesting because it resembled closely one of cerebral thrombosis, though the evident involvement of the left third nerve was not so easily explained in that way. Headaches, dizziness and unsteady gait, are not infrequently present in this condition. They were not complained of at all during the first month of the patient's residence at the hospital, and when they did appear, she could not make herself well understood on account of her aphasia. A complete history of the case was not obtained till after the patient's death. A knowledge of the presence of choked discs would have been of great value in making the diagnosis, but since brain tumor was not seriously considered, the eyes were not examined, and it is doubtful if they could have been on account of the restless, resistive condition of the patient. Without the involvement of the left third nerve, the case would scarcely have aroused a suspicion of anything but cerebral thrombosis or possibly hemorrhage which is a much rarer condition in old age. The speech defects, although not studied exhaustively, seemed to point toward impaired functions of the auditory word center and its connections. There was not complete word deafness, although the involvement of the left temporal lobe was so extensive. It seems likely that the paralysis of the right side was due largely to the pressure of the nodule of tumor on the ieft crus cerebri. It is difficult to arrive at definite conclusions, as the tumor was so extensive, and the softening so general. The softening immediately about the tumor was not appreciable macroscopically, but involved quite generally the whole white substance, being a little more marked on the left than on the right side. With brain tumor, the softening is usually immediately about the tumor, and such

general softening, caused undoubtedly by a general reduction of the blood supply to the cerebrum, is at least uncommon. This general reduction of the blood supply to the cerebrum may have been caused by the increased intracranial pressure due to the large tumor in the presence of atheromatous arteries, or the tumor on the left crus cerebri, which was in the Circle of Willis, may by direct pressure on the vessels at this point have caused a general reduction in the blood supply. One would expect the cerebellum to escape no matter to which one of these two causes the softening was due. The softening could scarcely have been brought about wholly by changes in the arteries, for only the lumen of the left middle cerebral artery was narrowed, whereas the softening was general, but distinctly more marked in the white substance. This is where the softening would first appear, and be most marked if there was partial, but not complete, shutting off of the blood supply.

I wish to express my indebtedness to Dr. P. C. Bartlett for the accompanying illustrations.

ACUTE PARESIS WITH REPORT OF A CASE; THE CLINICAL HISTORY AND PATHOLOGICAL FINDINGS.

By STEWART PATON, M. D., and G. Y. RUSK, M. D., Baltimore.
(From the Laboratory of the Sheppard and Enoch Pratt Hospital.)

At present alienists group under the head of general paresis a number of atypical forms which are of interest alike to the clinician and to the pathologist. Not only do these irregular types present symptoms which distinguish them clinically from the classical picture of the disease, but the pathological changes in the central nervous system are in a measure distinctive. According to Lissauer the typical forms of paresis include about 80 per cent of all the cases. The same writer[1] classifies the atypical forms as follows: To the first group belong the cases in which the pathologic process does not affect the frontal lobes but is confined chiefly to the posterior portions of the hemispheres. A second group, comparatively common, includes those cases which both in their clinical picture as well as their pathologic alterations bear a striking resemblance to certain forms of senile dementia. In other cases, again, the lesions are most marked in the cerebellum and consequently the symptoms may suggest the presence of a cerebellar tumor. Still another group is made up of cases whose symptoms are characterized by a course which suggests the acute delirium or amentia of Meynert. The cellular alterations are not confined to any definite area but are equally well marked in all portions of the central nervous system. Finally, there is a comparatively small number of cases in which the pathologic changes appear primarily in the optic thalamus and a few instances are reported in which the paretic process complicates tabes, giving rise to a peculiar hallucinatory form of delirium.

[1] Lissauer: Neurol. Centralbl. Jan. 16, 1902, Nr. 2, S. 86.

A form of dementia paralytica marked by an acute onset and short duration is relatively of infrequent occurrence and is referred to as *galloping paresis* or as the "*forme foudroyante.*"

Buchholz[1] has called attention to the fact that cases of galloping paresis only occasionally come under the observation of the alienist. The idea, which seems to prevail somewhat widely, that this form of the disease is not uncommon, can hardly be substantiated. Many of the patients who enter hospitals for the insane and whose symptoms simulate those belonging to acute delirium have unquestionably gone through a subacute or chronic initial period followed by an acute exacerbation. In some instances this initial period, although extending over a number of months or even years, is marked by a degree of mental aberration so slight that it is commonly looked upon as "a change in the character" of the patient, and is not attended by the synchronous appearance of pronounced physical symptoms. Numerous observers have directed attention to the important fact that, although many paretics during the early stages of the disease show only slight symptoms of alienation, the apparent mildness of the affection does not preclude the concurrence of well marked and extensive alterations in the central nervous system. The disparity that may exist between the mental disturbances on the one hand and progressive destructive lesions in the cortex and basic ganglia is a matter of considerable interest. Unquestionably in many cases in which the symptomatic expression of the organic changes has been quite limited in degree, acute symptoms may develop, which are then to be regarded as coincident with the lighting up and rapid extension of the pathological process. These cases, clinically as well as pathologically, should be excluded from the group under discussion. It is also necessary that the immediate cause of death of the patient should be determined before we can finally decide whether or not the case belongs to the *forme foudroyante.*

In analyzing statistics of cases, all those in which death has been due to some intercurrent disease during an acute exacerbation of the paretic process should be eliminated from this group. For example, Buchholz[1] has called attention to the fact that

[1] Buchholz: Arch. f. Psych. u. Nervenkr., XXXVI, H. 2.
[1] Buchholz: Op. cit.

during an exacerbation several cases diagnosed as acute paresis succumbed to pulmonary tuberculosis, one to purulent pericarditis, two to rupture of the bladder and others to various lesions, not the direct result of the paretic process. During twenty-four years 335 paretics were admitted to the Marburg clinic. Of these only four clearly represent the acute type of paresis. Bearing these facts in mind it may be said that only those cases which present the following features should be classified under the *forme foudroyante*.

(1) Either the clinical history must be so complete as to render it possible to eliminate the occurrence of a prodromal period in which the symptoms are of a subacute or chronic type; or

(2) If the patient dies during the period of acute delirious excitement it is essential that the pathologist should determine whether there is a definite organic lesion present sufficient to have caused death.

(3) If the pathological findings indicate the existence in the central nervous system of a subacute or chronic process the case cannot be included in this group. The deductions based upon the pathological findings are decisive even although the clinical history may suggest an acute onset and termination.

The history of the following case is of interest for two reasons. Although it is possible that the clinical history may be deficient in regard to the symptoms of the patient during the months prior to his admission to the hospital, the character of the histological changes proves that the lesions in the central nervous system were all of an acute character. This is equally true of the vascular, neuroglia and nerve changes. Consequently, there is no evidence present which would justify the assumption that the patient passed through a prolonged initial stage.

Male, aged 37, married, admitted to the Sheppard and Enoch Pratt Hospital October 29, 1901. Died March 2, 1902.

Family History.—Negative.

Personal History.—No history of any severe illness. No previous alienation. The patient says he was infected with lues several years ago, and that he was under treatment three years. This statement could not be confirmed.

Present illness.—During September, 1901, the patient began to lose interest in his work, became quite nervous, worried about

his book entries, and suffered from digestive disturbances for which he consulted a physician. Two weeks before admission to the hospital he stopped work altogether, became somewhat apathetic; at times complained that his heart was in poor condition and said that he was afraid he would die. He was very sleepless, began to talk to himself and had vague ideas that persons were coming into the house at night. He was also troubled with auditory hallucinations maintaining that people were talking about him. A few days before admission to the hospital he became much worse, but at no time was violent.

Examination, October 30: Patient was lying in bed, apparently quite comfortable; took notice of persons entering the room and nodded pleasantly. Knew his name; when asked age replied that he was born in 1864. Unable to give his age in years. Does not remember the month of his birth. Affirms that his memory is affected. When he tries to speak his tongue becomes first tremulous and then immovable as if the muscles were easily fatigued. The lips and muscles of the face are contracted, the resulting expression suggesting the risus sardonicus. At times the deeper muscles are thrown into play, and the lower jaw is frequently moved to the right. The lips at times are puckered and the words come with explosive force. There is some slight slurring and a tendency to drop syllables. The speech is in no way characteristic of a typical case of paresis. The patient is unable to give any connected account of his illness, does not know how long he has been in the hospital or when he left home. At times it is difficult to tell whether sensory stimuli from without reach the cortex. The fact that he pays no attention to most of the questions that are asked him may account for the fact that he fails to respond. He suddenly becomes quite emotional; talks about having contracted syphilis several years ago and fears that he may have given the disease to his wife; has marked religious fears, is anxious to know whether he can be saved. Occasionally he complains of hearing voices which tell him disagreeable things. The only thing said to him by these imaginary voices that he will repeat is the word "devil." As soon as he hears this he is impelled to say the same word. His lips move but he does not express the word audibly. He talks in a more or less incoherent way about his

business affairs; affirms that the mental strain connected with his business was the immediate cause of his breakdown. Occasionally he suddenly springs up in bed and points to the electric light fixtures which he would have removed at once. Apparently the auditory hallucinations from which he suffers are believed by him to emanate from the fixtures. Once during the examination, he jumped up in bed, threw off the coverings and went through the motions of taking a bath. When he became quiet he did not seem to remember exactly what he had done. He would give no reason for his action except to say once "It's putrid."

Physical Examination.—Strong frame but poorly nourished man. Face symmetrical except when the patient becomes emotional; shows no particular expression. He holds his mouth partly open most of the time and sets his eyes as if looking at some object in the distance. Generally, however, he takes an interest in what is going on about him and follows the movements of persons in the room. The pupils are equal, dilated; the direct and consensual reactions for light are normal; accommodation is also normal. The right iris contains a brown pigmented streak, for about 30 degrees of the circumference. The eyebrows are weak and grow down to just above the bridge of the nose. The ears show practically no anomaly. The tongue is slightly coated; the breath is bad. The teeth are somewhat decayed. The palate is rather narrow and high vaulted.

Reflexes.—Dermatographia is fairly well marked; comes out rapidly and lasts a considerable time. There is a narrow central zone of hyperæmia with a broader bordering zone of anæmia. The abdominal skin reflex is scarcely perceptible; the cremasteric reflexes are present on both sides. The radial and triceps reflexes are active. The patellar reflexes are present; no ankle clonus. On scratching the bottom of the foot there is slight extension of the 3d and 4th toe but no movement of the great toe; no jaw reflex is obtainable.

Muscles.—There is no apparent insufficiency in the eye muscles although the patient is unable to concentrate his attention sufficiently to allow of a satisfactory examination. There is no nystagmus. The grip in the two hands is markedly different. The patient cannot be made to take the dynamometer in one

hand only, but insists on squeezing the instrument with both and in this way he can force the needle to 70. In squeezing the observer's hand the greatest force at first is in the right hand, but when the pressure is continued, there is a marked general tremor of all the muscles. He maintains grip on the first trial for ten seconds, on the second for eight seconds. In left hand initial grip is not quite so strong but he maintains practically the same pressure without tremor for three quarters of a minute, after which there is a slight decrease in pressure which has not lessened at the end of two minutes.

Chest.—Well formed, symmetrical and clear on percussion and auscultation.

Heart.—No marked enlargement. Sounds clear at apex and base; second sounds at base slightly accentuated. Pulse 84 to the minute; very slightly irregular in rhythm. Arteries slightly sclerotic having a diffuse rubber-tubing like feel. Pulse soft and easily compressed; no marked change in the temporal arteries.

Abdomen.—Symmetrical, negative on palpation and percussion; no points of tenderness.

Inguinal Glands.—Slightly enlarged on either side, firm but showing no shotty consistence. No nodes on the tibiæ; a few copper-colored spots are noted near the lower end of the right leg. Toward the end of the examination the patient became very emotional, affirmed that his wife had had to sell her house in order to keep him in the hospital, and reverted to the subject of his religious affairs.

Urine.—800 cc. (24 hours); clear, acid; s. g. 1025, distinct trace of albumin, urea .034; indican diminished; no casts; numerous leucocytes.

October 31: During the morning the patient was so restless that it was necessary to restrain him in bed. In the afternoon he was able to sit up. When addressed looked disturbed and became decidedly emotional; was glancing over the pages of a book and when asked what he was doing said he was "trying to see where the two books came together which would make three words." He spoke with little hesitation and less facial movement, remembered his own name as well as having seen the observer before; no idea of time; can write his own name.

When asked to write his address he wrote "Emmet" and then the word "address." He continued writing. His letters were well formed but did not make any words. He was unable to take five from a hundred mentally and so on down to zero, but managed to make a few subtractions on paper. Unable to fix his attention. After further explanation he wrote five under one hundred and then drew a line as if intending to add and wrote down 1005; also said various numbers, 1767 and 1867. Made some remarks about his business, but a moment afterward could not explain his remarks or his reference to numbers and said the inquiry should be made of his sister who did his talking for him. Asked the examiner if he had any heads saying that he wanted to borrow one as his own was out of order. No Romberg symptom could be elicited. Apparently there was no marked incoordination in the movements of his arms. The patient continuaily made chewing movement for which he could not give any explanation. Frequently looked in the mirror and changed in some minor detail the arrangement of his clothes. When asked about the voices which had spoken to him he replied that he had heard them to-day but could give absolutely no connected account of what they had said to him.

November 2: When patient makes any muscular movement such as opening the mouth, eyes or protruding the tongue there is a considerable amount of incoordination; when asked to close his eyes tightly he does not seem to understand and raises his eyebrows. Voluntary motor impulses are weak; the speech is low and muttering. When asked where he was he replied "Here;" then in a second said "Pittsburg." When he attempts to reply to questions there is marked exaggerated muscular contraction about the angles of the mouth and the chewing motion of lower jaw. When his arms are held out there are involuntary and incoordinated movements, choreiform in character. These movements are sometimes seen in the toes. When the patient is uncovered he makes no attempt to cover himself. When shown a watch, knife or a penny he becomes excited, numbles to himself, and tries to get up. When hands are clapped near the patient's head he closes his eyes, moves his head slightly to to one side and seems to be amused.

November 9: The patient is more cheerful and apparently in

better physical condition than when last seen. Conversation slightly more connected and logical; delusions principally of a semi-religious character. Says he loves every one and wants to be loved by every one. Has made several excursions to Heaven where he describes meeting "persons as tall as the room." Affirms that these people are aldermen. As soon as he has said this he realizes that he has made a mistake and apparently tries to apprehend the word angel, although in a few seconds his mind turns to something else before he has said the word. Apparently no real aphasia. Patient recognizes objects shown to him and can read isolated words or sentences.

November 13: Patient more disturbed. When first seen was crying, asked examiner his name; immediately began to reaffirm his love for everybody; hoped that every one was saved; made disconnected remarks about Christians, Jews, Russians and a supposed fight which he said began on Monday. Started to pray aloud, at times repeated sentences and said "Amen" a number of times in succession. While he was talking his toes were pinched, but this made little impression upon him. The flow of words gradually stopped but he made no attempt to draw away his foot nor did he seem to notice what was being done.

Urine 690 cc. (24 hours), acid, 1025, albumin, trace; urea .025; a few blood casts.

November 19: Patient much more excited; very noisy, continually writing and using a number of inarticulate expressions. Only once has he been aggressively violent; then he seized his slippers and threatened to kill any one who came near him; a little persuasion made him give up one of the slippers but he insisted on retaining the other, until finally he had to be overpowered. At times reiterates "rum dum dum," does not, however, seem to have any stereotypia.

November 21: As soon as one of the doctors entered the room this morning the patient called him a Russian and said that another person in the room was English. He is quieter and apparently somewhat more rational. Admits having seen those about him but does not remember any of their names. Remembers seeing attendant; when asked what the attendant does for him replied "he feeds me, shaves and fixes ice for me and many other things." Recognizes the fact that he is ill. When shown

a knife, by a rather rapid association of ideas, he speaks of the blades, but it is some time before he says the word "knife." Still troubled by auditory hallucinations. Goes up to a small hole in the wall of the room and tries to talk through it; locates the voices that he hears in this hole. Is cleanly in his habits; his language is never anything but proper; takes some interest in statements made concerning his condition and apparently listens attentively, but does not show by his facial expression that he appreciates what is said.

December 1: (Extract from nurse's notes.) Patient has been delirious a great deal of the time, has been restrained by a sheet; generally more quiet between the hours of 10 a. m. and 3 p. m.; then is apt to become resistant, even threatening. At other times he is hilarious, occasionally depressed and weakened; appetite as a rule, poor; at times he refuses food or spits it out after he has taken it into his mouth; occasionally vomits after having apparently eaten with relish. Bowels, as a rule, are constipated. During the last few days habits have become very bad. Samples of speech as recorded by the nurse were: "Dine, fine, heres a place for you and I'm dam with I'm if you do." "I do down make one of the sacrifice, us, me an even sam tell steel, sam the sea." "Was not afraid of our trader, do not grab her, tell me sin fring, grap to grap to gratsify me takes in worry tis kick to the highest if that was steel steel if that was the hottest that fineside and sing side matters in will wife died to save her, you do not believe, you just scrat down."

December 19: Necessary to restrain patient in bed most of the time. Only occasionally quiets down. The changes in mood are very sudden. For example, he took a dose of medicine without objecting. Five minutes later, when the attendant brought him eggnog, he absolutely refused to take it and became wildly excited. A few minutes later he was again quiet and took eggnog without any trouble.

January 17: Much quieter; able to be up and about. Blood pressure 130 mm.; a few minutes later, when the patient became restless, it rose to 145. He made no objection to his blood pressure being taken. During the latter part of the month the patient was frequently violent; said that his food was poisoned and talked a great deal about fighting. He was visited by his sis-

ter and cousin, and although incoherent in talking to them apparently recognized them, cried, put his arms around them and kissed them.

January 18: When asked to write his name he first wrote Washington. He was asked to write figures, to add, multiply, divide and find square roots. All these he did accurately and with great rapidity.

January 27: His eyes were examined by Dr. Harry Friedenwald. The discs were hyperæmic, sharp in outline; vessels not tortuous.

February 16: Reflexes the same as when previously examined. The patient has quieted down markedly; remembers things that he did during his stage of excitement, speaks of being strapped down in bed, of having been crazy and of still being crazy; he knows it, he says "because he can do it with his eyes." Rolls his eyes upwards and inwards. Still has delusions of having been in Heaven, says that when he left there he was a little yankee doodle.

February 23: This morning about 6 a. m. the patient was found in convulsions. From this time until 3 p. m. he had 19 well marked seizures. At noon he was apparently unconscious; there were marked general sweating and retention of saliva in the mouth; the tongue was bloody from having been bitten; the expiration was shallow; he occasionally swallows and the muscles of the neck act equally. The eyes are fixed toward the right and upward. At times there are slight movements of the eye-balls, somewhat rhythmic and suggesting nystagmus. The conjunctivæ are markedly injected; to ordinary light the pupils are equal, of about normal size; both react promptly to light. There is a minimal amount of fixation when the finger is put near either eye. An attempt was made to examine the fundus with the ophthalmoscope; but the light thrown into the eye caused so much movement of the eye-balls that the results were not satisfactory. The discs and fundus, however, seemed to be somewhat hyperæmic. Pain sense was practically absent. Patient could be pricked over the face, limbs and hands with a pin without showing any reaction either by way of movement or change of rhythm in respiration. The superficial abdominal reflexes were obtained; the cremasteric and plantar could not be

elicited; dermatographia came out very sluggishly, but was quite persistent. The line was narrow and red without any elevation and with no anæmic zone. Both patellar reflexes were present and equal; the triceps reflexes were present, the right being perhaps slightly more active than the left. The radial reflex was obtained on the right but not on the left side. Some asymmetry of the face was noted; the blood pressure taken in the middle of the afternoon after the last attack was 105 mm.; during the morning the temperature rose to 105°, and the pulse to 144.

February 23: Gradually coming out of the semicomatose condition. He appears to recognize those about him and makes an effort to answer questions but stops after saying a few words. The reflexes have changed markedly in character since yesterday and are now practically the same as they were before the attack.

February 26: Slight general improvement. Blood pressure 182 at noon. The nurse says that when the patient read aloud, if he read very slowly, he was able to follow the words. As soon as he began to speak rapidly all connection was lost. His ideas were very fantastic; he spoke of a little girl named " Raspberry," and told stories about her. About the middle of the month his ideas and delusions first became definitely expansive. His actions were quick and impulsive; he frequently jumped up in his chair; his face became very red, and he paced up and down the room; spoke of his great strength and his power to cope with the whole world. He frequently asked rational questions, but for the most part his conversation was disconnected.

February 28: The patient is distinctly worse, is very drowsy; is troubled with hiccough; the respiration is regular, without any suggestion of the Cheyne-Stokes character, but there is unusually deep, quick inspiration and forced expiration, the short pause being relatively much lengthened. On auscultation there is no evidence of any pulmonary lesion. The heart sounds are rapid; the first sound is impure at the apex; the second sound is accentuated at the base. A very small amount of urine was obtained by catheterization. This showed albumin, a few casts, no blood; there was not sufficient to obtain the specific gravity. The patient sank rapidly and died March 2.

The autopsy was held two hours after death. The body was

warm, fairly well nourished; rigor mortis not developed; abdomen distended, no scar on glans penis. The skull-cap is not adherent to the membranes; no roughening on the inner surface of the skull or outer surface of the dura. There are a few pin-point adhesions along the mid-line of skull. The inner surface of the dura is adherent to the pia arachnoid. Vessels of the pia arachnoid are not unusually prominent. The pia presents a large area of opacity, bilaterally situated, most marked in the anterior end of the praecuneus running forward over the frontal lobes and downward as far as the lower border of the second frontal convolution. There is also an area of opacity about 1½ inches long extending from the fissure of Rolando over the superior frontal convolution. Over the base the pia shows no opacity.

Sections of the dura taken from over the frontal area show a small number of hæmorrhages in which the blood corpuscles still retain a practically normal appearance. There is no attempt at organization of the clot and the surface of the dura is not appreciably depressed by the hæmorrhages.

Summary of General Anatomical Findings.—Pachymeningitis hæmorrhagica; chronic diffuse nephritis of mild degree; marked fatty degeneration of the liver; a small area of bronchitis due to the presence of an infected mass.

In brief the microscopic appearances of the different organs are as follows:

Heart Muscle.—Owing to poor fixation, the nuclei of the muscle fibres are stained diffusely and lightly. They show slight irregularity in outline, the pigment content of the cells is about normal. Muscle fibres teased in osmic acid do not show fatty degeneration. In certain areas a picture simulating fragmentation of the heart muscle is seen, but owing to the poor fixation the condition can not be definitely made out. There is no increase in fibrous tissue and no vascular lesions can be noted.

Lungs.—There is a slight focus of bronchitis associated with the presence of an infected mass in one of the small bronchi, due doubtless to inhalation. Otherwise the lungs are normal.

Liver.—There is a marked vacuolization of the liver cells especially in the periphery of the lobule diminishing as the centre is approached; it is least marked along the course of the sublobular veins. Towards the periphery of the lobule the vacu-

oles are at times larger than normal cells, the cell being represented by a rim of protoplasm with the nucleus pushed to one side. Portions of the liver teased in osmic acid demonstrate that the vacuoles seen in section are due to extensive fatty degeneration. There is no evidence of connective tissue increase.

Sections of the *pancreas* show auto-digestion; no lesions were found in the parenchyma or islands of Langerhans.

The splenic pulp elements are apparently normal.

Kidneys.—The fixation is so poor that practically none of the nuclei of the parenchyma are stained. There is a certain amount of small round-celled infiltration, the nuclei staining darkly. This is particularly true in the glomeruli. In general the outline of the parenchymatous cells is not discernible, but the epithelium seems reduced in height and much detritus is found in the lumina of the tubules. Most of this takes the stain as if it were albuminous in character; while a portion assumes a dark yellowish brown color suggesting altered blood pigment. There is no fresh blood found in the tubules. The capillaries and veins of the kidney are distended with blood. In one medium-sized artery there is a fairly well marked endarteritis.

The central nervous system.—Sections were taken from the following convolutions: the first and second frontal, Broca's anterior and posterior central, the superior temporal, occipital, superior parietal, cuneus and paracentral. In sections stained by the Weigert mitosis method there is little, if any, evidence of mitotic changes in the neuroglia cells. For the special study of neuroglia the differential stains of Mallory[4] and Benda as given by Huber[5] were employed. Sections through the medulla were stained by both Mallory's and Huber's methods. Those from the cortex, namely the paracentral, cuneus, and superior frontal convolutions, were stained by Benda's method only. The medulla appears normal in its glial contents; the nuclei are regular in outline and quite frequently a distinct surrounding rim of protoplasm is to be made out. In the white matter cells with considerable protoplasm are seen. A process of the cell protoplasm may be observed bounded by and terminating in glial

[4] Mallory: Jour. Exp. Med., Vol. X, p. 19.
[5] Huber: Amer. Jour. of Anat., Vol. I, p. 45.

fibres. On the whole, one obtains the impression that there is a more marked and frequent relationship existing between glial fibres and the cells than one is led to believe from the observations of Weigert.

From a comparative study of the various areas of the cortex one finds the greatest thickness of subpial glia in the frontal area and next in the cuneus, while the paracentral shows a very thin layer. Whether there is a real increase of glia in the frontal region it is difficult to say. Against a pathological increase is the fact that the glial cells in this outermost layer are small with but little protoplasm and in most instances stand in definite relation to a system of fibres which radiate from the cell. It is hardly conceivable that the glial cell with its complexity of fibres can, as a whole, divide. No cells having the appearance of dividing cells were encountered. Again, in the areas where the relation of pial vessels to cortex can be made out, there is no special number of processes, in fact there are remarkably few which radiate above the surface of the cortex to the pial vessels. The nuclei in this area are variously shaped and present extreme degrees of polymorphism. As soon however, as one goes below the surface, especially in the frontal region, the picture changes. Both the protoplasm and nucleus of the glial cells are increased in size. Still further down in the cortex, especially about the small arteries, the glial cells are arranged along the vessels and send their prolongations to the vessel wall, often showing conical expansions which have been described. Besides these, other cells lie scattered in the intermediate tissue which are morphologically equivalent to the cells just mentioned but which seem to have no relation to vessels. Some of these cells have a comparatively small amount of protoplasm and the fibres take the differential stain well but more especially in the frontal region the fibres of similar cells are broader and retain the differential stain less readily, suggesting the protoplasm of the cell. The cell bodies and the nuclei are increased in size. Of some importance is the presence in many of the cell bodies of small dots, usually two in number which take the differential stain. These may be spherical or oval and in very well differentiated specimens there may be observed a slight area of different refractibility immediately surrounding such a dot. They usually lie quite near the nucleus

but occasionally at a considerable distance from it. These dots are probably those to which Mallory has called attention, in cells found in three tumors arising from the ependyma and which both he and Weigert considered diagnostic of cells of ependymal origin. Before discussing this point further we will consider those glia cells (mesoglia of Robertson) which are normally found lying in the pericellular space and which, as a rule, have practically neither protoplasm nor fibres. In this case there is frequently to be made out a slight amount of protoplasm but occasionally a relatively large mass of it surrounds these nuclei. One remarkable picture (see Fig. 4) is presented by a nerve cell encroached upon by an enormous glia cell. The nucleus in the nerve and also in the glia cell is increased in size and the latter cell contains the two dots giving the differential glia stain referred to above. Alongside of this abnormal glia cell is a second, apparently normal. Both of these cells occupy the same pericellular space. In this connection it is of interest to recall the fact that similar dots have been found in cells in malignant new growths, where, as is generally conceded, cells assume a type that suggest their embryological condition. These glial cells, which we have described, show an increase in protoplasm and possibly represent a stage preparatory to division. Moreover it is interesting to note that these dots are present in the type of cell which Robertson refers to as mesoglia. If our assumption as to their significance be true, it is probable that they are of the same origin as the ordinary neuroglia cell. If this hypothesis is correct, it would afford a strong argument against the position taken by Robertson that mesoglia is of mesodermal origin. There is a marked gliosis about several of the small arteries and the glia fibres are seen to fill up the perivascular space. In the meshes of the network are many cells similar to those which have been described in the Nissl preparations.

Nerve cells.—Sections were taken from the first and second frontal, Broca's convolution, anterior and posterior central, superior temporal, occipital, superior parietal and cuneus. The Nissl methylene-blue stain and Unna's polychrome solution were employed in the preparations of the sections. The intensity and extent of the lesions in the nerve cells were about equal in all the cortical areas examined.

In the motor area nearly all of the Betz cells contain a large amount of yellow pigment. This is situated near the base of the cell. In the sections stained with the Nissl methylene-blue the chromatic substance in the central part of the large cells is broken up into small masses. In some cells it has a decided powdery appearance. Along the periphery the Nissl granules often have a normal appearance. Frequently about the nucleus there is an accumulation of the stainable substance forming a narrow but deeply stained ring just outside the nuclear membrane which is clearly seen inside of this outer circle In a few of the larger cells the nuclear membrane cannot be distinguished. In many cells in the apical processes the chromatic substance shows little, if any, evidence of disintegration. The chromatolysis has extended further in the basal than in the apical direction. The nucleus is stained lightly a diffuse blue and is structureless except for the nucleolus and nuclear membrane. The nucleolus in all instances is stained intensely and its diameter is one-fifth or, in some instances, one-fourth of the diameter of that of the nucleus. Except in the central regions about the nucleus the achromatic tracts have not begun to take up the stain. But in the centre of the cell all these tracts are stained. In the large cells there are few, if any, nuclear foldings. This is in contrast to what is observed in the smaller cells. In the smaller pyramidal cells the nucleolus is not as large in proportion to the nucleus as it is in the larger cells. In the smaller elements the disappearance of the chromatic substance from the central portion of the cell is marked. The nuclei in many instances are kidney-shaped; the nucleoli are not as deeply stained as in the larger cells. In all the medium-sized as well as in the smallest pyramidal cells there is marked pigmentation. Surrounding the pyramidal cells of all sizes there is frequently seen an accumulation of small round nuclei. The actual encroachment of the latter upon the nerve cells cannot be made out. Some of the pyramidal cells present merely a shadowy outline. The chromatic substance in some instances has almost completely disappeared from them.

These changes have been noted in all areas of the cortex examined. The intercellular substance does not show any tendency to stain.

Specimens from the cortex stained by the Weigert-Pal method do not show great decrease in number of the tangential fibres. There is only a slight diminution in the number of the fibres throughout the whole cortical area and this is not limited to any one system. As yet we are unable to state any very definite conclusions regarding our study of the fibres in the cerebral cortex. We are inclined from our observations in this case to agree with the opinion expressed by Kaes[6] in his recent paper in which he affirms that in all cases of paresis there is a general and not a localized disappearance of the fibres from the cortex.

In certain sections of the cortex and in the medulla were found certain spherical bodies presenting regular outlines and of a perfectly homogeneous structure; when they were found broken the lines of cleavage were perfectly regular. They stain indifferently with any acid or basic stain which happens to be in excess. They readily decolorize, do not give the reaction for amyloid or fat and apparently bear no relation to myelin. They were also found in sections which had gone through the complicated processes for the Mallory and Benda neuroglia stains. The structure of these bodies was not determined, but their occurrence in this case of paresis as well as in a case of Huntington's chorea, recently reported by one of the writers[7] is of interest.

Vascular Changes.—In some of the large arteries, especially in and about Broca's convolution there is a marked cellular infiltration of the adventitia with here and there considerable pigmentation. Plasma cells are not infrequently found in the walls of both the larger and smaller vessels. We refer only to the plasma cell as it appears when stained by the Nissl or Unna method. It is an oblong cell with an eccentric nucleus, a clear space at one side of the nucleus and the chromatic substance lying at the periphery. Rows of plasma cells outline the walls of the vessels.

The cells were not found by us in the tissue surrounding the vessels. The importance of the plasma cell in general paresis

[6] Kaes: Monatsschr. f. Psych. u. Neurol., 1902, Bd. XII, Hft. 5.

[7] Rusk, G. Y.: A Case of Huntington's Chorea. Amer. Jour. of Insanity, Vol. LIX, No. 1, 1902.

has been emphasized by Vogt[8]. He examined the brains of 56 insane patients. Of these 14 were paretics and in all the cortices taken from these cases the plasma cells were found and often in considerable number. In the remaning 42 cases they were present in only 2 instances. In one of these cases the diagnosis of idiocy with brief periods of excitement had been made. In this instance only three plasma cells were found and these were close to a large vessel. They were found in a second case of idiocy with epileptiform attacks, but in this latter instance many of the clinical symptons of the paresis, as it occurs in young people, were present. The patient was only 15 years of age and there was a well marked history of hereditary syphilis. In addition to the plasma cells there was noted an increase of the glia about the small vessels and thickening of the pia arachnoid most marked over the anterior surfaces of the hemisphere.

Although Vogt admits that the plasma cell is frequently found in the meninges, he affirms that its occurrence in the cortical vessels of patients dying during a psychosis is pathognomonic of paresis. He does not deny the possibility of finding these cells in cases of organic brain lesions, but expresses the belief that paresis is the only psychosis in which this type occurs. In the limited amount of material at the Sheppard and Enoch Pratt Hospital we have been unable to find the plasma cells in the cortical vessels in any case except the present one. The cortices examined were taken from a case of dementia præcox, two cases of manic-depressive insanity and two cases of alienation associated with arteriosclerotic changes. The views of Vogt in regard to the importance of the plasma cell have not been generally confirmed. Havet[9] affirms that neither the plasma cell, as described by Vogt, nor the lymphocytic infiltration are characteristic of the paretic process.

Résumé.—It is probable that cases of acute paresis are of greater rarity than has commonly been supposed. In order to form an accurate judgment as to whether a given case may be

[8] Vogt, R.: Das Vorkommen von Plasmazellen in der menschlichen Hirnrinde nebst einigen Beiträgen zur Anatomie der Rindenerkrankungen. Monatsschrift für Psych. u. Neurol., 1901, Bd. IX, S. 211, 260.

[9] Bull. de l'Acad. Royale de Médecine de Belgique. IV série, t. XVI, No. 7, Séance du 26 juillet, 1902.

grouped under the *forme foudroyante*, it is not only essential that the subacute or chronic initial period be excluded by the history of the case, but the acuteness or chronicity of the pathological process in the central nervous system must be carefully considered. The pathological findings reveal nothing that is essentially characteristic of the disease. We have noted in particular a nerve-cell alteration which is in no sense pathognomonic. There is a general and not a localized disappearance of fibres from all cortical areas. The neuroglia shows an increase of the cellular elements, particularly of the larger size spider cells with but little, if any, increase of the fibres. The blood vessels, particularly the larger arteries of the cortex, are well filled with blood; in some cases this over-filling extends to the smallest vessels. Many round nuclei are found in the perivascular spaces. In most of the cortical areas, numbers of plasma cells are present. We have failed to find them in the tissue surrounding the vessels. The character of the changes in the various organs as well as in the central nervous system suggests a general intoxication. The vascular changes of the cortex are not sufficient to account for the degeneration of the nerve elements.

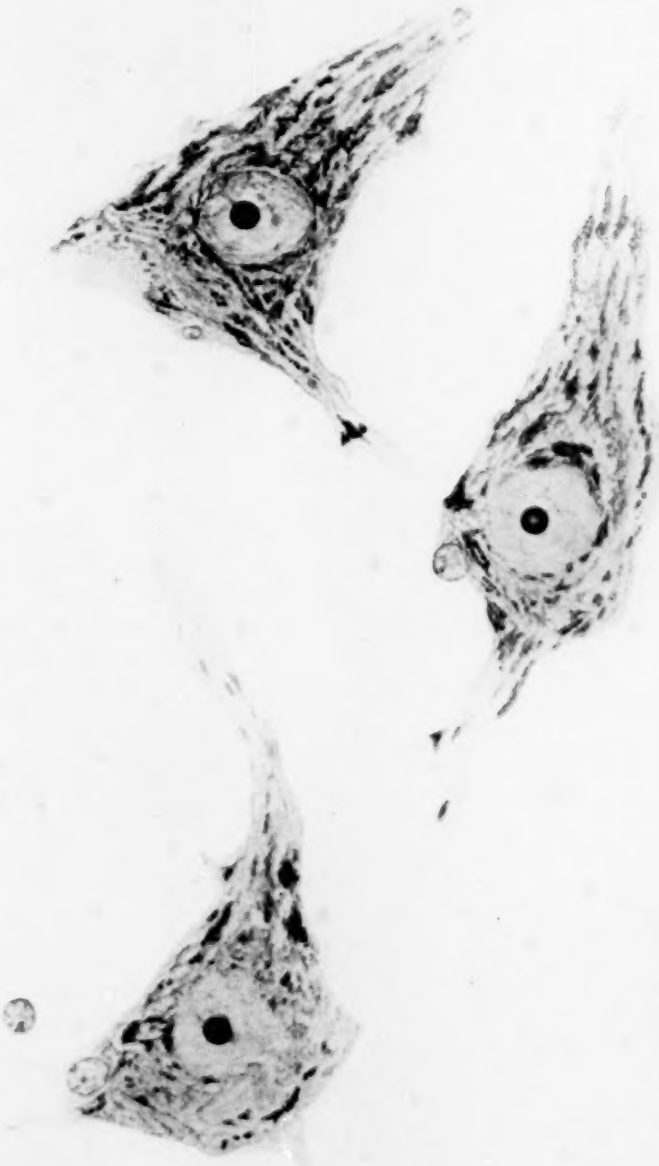
DESCRIPTION OF PLATES.

PLATE XIX.

Fig. 1. Large pyramidal cells from cerebral cortex, motor area.

PLATE XX.

Fig. 2. Small pyramidal cells cerebral cortex.
Fig. 3. Blood vessel from cerebral cortex; (a) plasma cells.
Fig. 4. Nerve cell with two neuroglia cells lying in pericellular space.



LX.X.

FIG. 1.

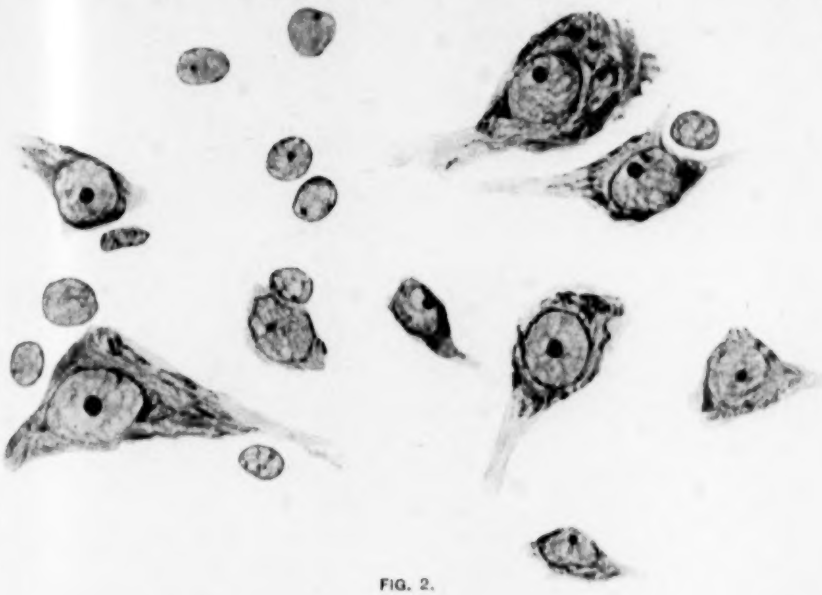


FIG. 2.

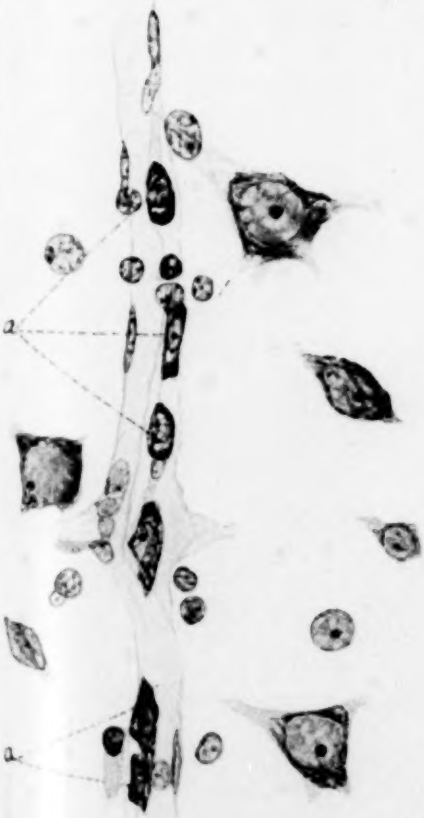


FIG. 3.

FIG. 4.

ON THE MOTOR CORTEX.

By CLARENCE B. FARRAR, M. D.,

From the Laboratory of the Sheppard and Enoch Pratt Hospital.

The doctrine of cerebral localization from its most shadowy beginnings is perhaps a century and a quarter old, although in its present form as a demonstrated postulate of science it numbers but the years of a single generation. Throughout the nineteenth century, philosophers, clinicians, and brain physiologists have followed one another in the occupation of this most fascinating question, and have contributed each their part to its final resolution, a consummation still far distant. It has been approached from five main view-points, in order of their antiquity, as follows:

(1) Speculative,
(2) Clinico-pathologic,
(3) Physiologic,
(4) Anatomic,
(5) Embryologic.

As mythology precedes history so phrenology came before rational cerebral physiology. The founders and chief exponents of this system were Gall and his disciple, Spurzheim, whose work embraces the closing years of the eighteenth century and the beginning of the nineteenth. Although based in the main upon the observation of accidents and coincidences, and built out by a tendency to *reading in*, the labors of these philosophers have also considerable clinical value and may be said to have opened the field in which was to be explored the modern question of brain centers. Two tenets of Gall's teaching have largely influenced the course of subsequent investigation and express in general present accepted belief, namely, (1) the intimate union between psychology and brain physiology, and (2) the essential principle—that specific functions reside in determinate areas in which they are *innate*. Two dozen or more such centers Gall

described—each presiding over a separate quality or operation of the mind.[1] It is noteworthy that a hundred years later, at the beginning of the twentieth century, a new defender[2] of phrenology should arise, whose deductions are in many respects more remarkable than those of the master.

Broca and Hughlings Jackson stand at the beginning of the clinical method. The first observations were in connection with speech disturbances, and even before Broca, Gall and others had noted that defects in articulation were associated with circumscribed lesions of the brain, particularly of the frontal region. It remained, however, for Broca (1863) to show that in right-handed individuals the part of the brain directly connected with motor speech is the base of the third left frontal convolution (Broca's center). This was the first step. Six years later Jackson contributed his classical work on Cortical Epilepsy. His statements are the more remarkable from the fact to which Hitzig[3] refers in his Hughlings Jackson lecture, that the observers of his time still entertained the misconception derived from the teaching of Flourens that the motor centers were situated exclusively in the corpus striatum. Jackson started with the postulate that the grey matter and it alone has the power of initiating movements. In his *study of convulsions* he describes the onset and course of the partial unilateral seizures which characterize the condition since called "Jacksonian Epilepsy." "When a fit begins in the hand," he wrote, "it goes *up* the arm and *down* the leg. Now patients who have fits beginning in the foot tell me that the spasm goes *up* the leg and *down* the arm." Here are the first definite suggestions of separate cortical areas representing various muscle groups, the successive involvement of which by contiguity determines the march of symptoms in the Jacksonian fit, and whose existence was soon so amply confirmed by physiological research.

In 1870 appeared the pioneer work of Hitzig and Fritsch. These observers by means of galvanic stimulation of the dog's

[1] Gall: *Sur les Functions du Cerveau et sur celles de chaque de ses Parties*, 1825.

[2] Hollander: *The Mental Functions of the Brain*, 1901.

[3] *Hughlings Jackson and the Cortical Centers in the Light of Physiological Research.* Brain, Winter, 1900.

cortex, confirmed the conclusions of Jackson and established beyond dispute the existence of *motor centers* in the brain. "Apart from a few empirical generalizations and brilliant hypotheses," Ferrier[4] remarks, "the doctrine of cerebral localization first entered on the stage of demonstration and prediction with the experimental researches begun by Fritsch and Hitzig in 1870." The motor area as defined by Hitzig was embraced in rather wide limits. In 1874 he wrote, "A considerable portion of the cerebral hemispheres, one may say, nearly a half, is directly related to muscular movements, while the remainder evidently has no connection with them—at least not directly." He believed that the Rolandic area was a pure motor zone, in the sense that here arose the actual impulses which found direct expression in muscular movements, at the same time agreeing with Jackson that it was not a pure motor zone in the sense that here were represented in close juxtaposition centers for incoming sensory and outgoing motor impulses. According to his recent statement, this area is the seat of *muscle consciousness*, the place of the "apperceptive working up" of sensory impressions into motor images. The central elements for the innervation of a given muscle group, are in general, he believes, distributed over the whole motor cortex, being more closely collected in only a few points—the areas of maximum representation. With the precentral convolution he associates the origin of voluntary movements pre-eminently.[5]

Following Hitzig, many observers have attacked the question of localization from the standpoint of animal experiment—Ferrier (1873), Munk, Schiff, Horsley and Beevor, Goltz, Bastian, Bianchi, Sherrington and Grünbaum (1901), and others. Their deductions have by no means all harmonized, being indeed often antagonistic on essential points. They have, however, stimulated investigation along more conservative lines, serving as checks upon speculation, and the original premise of Hitzig has been abundantly established, namely, that certain parts of the cortex are intimately associated with motor phenomena, while

[4] *Cortical Localisation in its Practical Relations.* Brain, July, 1889.

[5] Hughlings Jackson Lecture, cit. supra; v. also Neurol. Centralb., 16 Nov., 1901, and Centralb. f. Nervenheilk. u. Psychiatrie, Dec., 1901.

the remaining parts have no such direct relation. Moreover, these areas have been defined within fairly accurate limits, including the representation for the various muscles and muscle groups.

No other worker in this field has excited so much controversy, often such violent opposition, or has achieved more brilliant results than Flechsig. From observations on the time of myelinization of the various tracts in the central nervous system, Flechsig[*] divides cortical areas into two great groups, (1) sensory (projection) centers, and (2) association centers.

Under the term "Körperfühlsphäre" (Munk used this term to indicate the Rolandic zone), he includes all those regions in which terminate sensory tracts carrying impulses from skin, muscles, joints and organs (the special sensory areas, cuneus, first temporal and uncinate gyrus being excluded). This extended region of general sensibility comprises the central convolutions, base of the first frontal, the paracentral lobule, and the entire limbic lobe (callosal gyrus and hippocampus), all of which show advanced myelinization at birth. It is further expanded by another system, including the pole of the first frontal and the bases of the second and third frontal, in which myeline appears during the first months of independent existence. The fibres which make up this wide distribution represent the upward continuations of the posterior column fibres of the cord, interrupted in the lateral nucleus of the optic thalamus, and all approximated in the *carrefour sensitif* of Charcot, where myelinization can be seen at a period when all the remainder of the internal capsule in front, which is to be occupied by the pyramidal tract, remains unstained. By the term "Tastsphäre," Flechsig distinguishes that part of the territory of general sensibility which is comprised in the Rolandic zone. It represents the earliest of his myelogenetic systems and constitutes the center *par excellence* for tactile, kinæsthetic and stereognostic sensibility. The postcentral convolution, he maintains, is predominantly sensory, receiving the terminations of the posterior

[*] Flechsig, Neurol. Centralbl., No. 19, 1894. *Gehirn und Seele*, 1896. *Die Localisation d. geistigen Vorgänge insbesondere d. Sinnesempfindungen des Menschen*, 1896.

column fibres, while the precentral is predominantly motor, containing the cells of origin of the pyramidal tracts.[7] To this point there will be occasion to refer hereafter. Roughly, one-third of the cortical surface Flechsig showed to be thus directly connected with the periphery by means of projection fibres, and representing the primordial myelogenetic areas. These are distributed among four primary centers in order of development as follows: (1) Tastsphäre (somæsthetic area, motor zone), embracing the central convolutions; (2) olfactory area (possibly also including taste), hippocampus and uncus; (3) visual area, occipital lobe, calcarine fissure; (4) auditory area, first temporal convolution, especially that part which is concealed in the fossa of Sylvius.

The remaining two-thirds of the cortex show no myelinization at birth and remain relatively poor in projection fibres. They make up the association centers, the seat of the intelligence according to Flechsig, which by their marked development in the human species, differentiate man from the lower animals. Three such centers are described: (1) Anterior, including a large portion of the prefrontal lobe, the seat of the "superior psychism" of the Italians; (2) middle or insular association area, the converging center for the motor and sensory tracts concerned in language; (3) posterior, the largest of the three, extending over parts of the parietal, occipital and temporal lobes, and constituting the center for visual and auditory word memories.

To discuss the theory of Flechsig or consider the criticisms of his work, would leave no time for other matters.[8] His original conception of projection and association centers gave a distinctly new view of cerebral physiology, and in general terms has been accepted by the majority of observers, although few are able to follow him in his ultimate deductions. Munk[9] rejects entirely the theory of sensory and association or thought

[7] *Developmental (myelogenetic) Localisation of the Cerebral Cortex in the Human Subject.* Lancet, Oct. 19, 1901.

[8] V. Centralbl. f. Nervenheilk. u. Psychiatrie, Oct., 1896. Also a series of polemics between Hitzig and Flechsig, Nevraxe, 1900, I, 3; II, 1; 1901, I, 2.

[9] Ref. Neurol. Centralbl., März 1, 1902.

centers. Vogt,[10] a former pupil of Flechsig, was one of the first to raise his voice in opposition. "En construisant sa théorie," he declares, "Flechsig n'a pas suffisamment étudié ses coupes." It is doubtless true that Flechsig has overestimated the value of the myelinization method in the delimitation of cortical centers; and one can imagine of what the distinguished professor at Halle was thinking when he observed that the two requisite qualifications in scientific work were "keenness of observation and curbing the imagination." Flechsig's brain maps are undergoing frequent alteration and one must always be under the fear that one has not the latest edition.

It remains to speak of the histologic method and the service it has rendered in the differentiation of functionally separate cortical areas. Meynert[11] was the first to describe the minute anatomy of the cortex, dividing it into a series of layers, each possessing individual characteristics. He did not, however, recognize the structural differences which various convolutions present, and his description may be regarded as applicable in general to the association zones. According to Meynert, the cortex may be separated into five distinct laminæ: (1) A narrow subpial layer containing few small cells; (2) layer of numerous small cells closely crowded together; (3) layer of large pyramidal cells; (4) layer of small irregular cells (granular zone of the authors); (5) layer of spindle cells.

Betz,[12] in 1881, first pointed out the essential characteristic which distinguishes motor from sensory regions, namely, the presence of extremely large pyramidal cells in the neighborhood of Meynert's fourth layer. These cells reach their most colossal dimensions in the paracentral lobule, and were named by Betz *Riesenpyramiden* or giant cells. In recognizing a sensory and a motor cortex, Betz drew an analogy from the functional arrangement in the cord and argued that the same arrangement held for the brain, there being an anterior or motor pole and a posterior or sensory pole.

Hammarberg,[13] in 1895, gave a detailed description of the

[10] Jour. d. Physiol. et d. Path. Gén., juillet, 1900.

[11] Stricker's Handbuch d. Gewebelehre, 1871.

[12] *Ueber die feinere Structur der menschlichen Gehirnrinde.* Centralbl. f. d. med. Wissensch., 1881, Nr. 11-13.

[13] *Untersuchungen über d. norm. Anat. der Hirnrinde,* 1895.

motor and sensory types of cortex and called attention to the presence of Betz's cells in the former, and especially to the fact that here also the cells of the granular zone (Meynert's fourth layer) are conspicuously few or absent. Hammarberg describes six layers in the grey matter: (1) Molecular layer, (2) small pyramidal cells, (3) medium and large pyramidal cells, (4) granular layer, (5) Betz's cells and medium pyramidal cells, (6) spindle cells.

The most significant work in cortical histology is that which has been done by S. Ramón y Cajal since 1890. In that year from observations on the cortices of small mammals this author[14] described four essential laminæ: (1) Molecular, (2) small pyramidal cells, (3) large pyramidal cells, (4) polymorphous cells. In his monograph on the motor cortex in man (1900) Cajal[15] enumerates eight layers: (1) Plexiform or molecular layer, (2) small pyramidal cells, (3) medium pyramidal cells, (4) external zone of large pyramidal cells, (5) granular zone (Meynert's fourth layer) containing small irregular and stellate cells and small pyramidal cells, (6) Betz's cells—ganglionic cells of Bevan Lewis, (7) polymorphous, triangular, and medium pyramidal cells, (8) spindle cells.

Cajal agrees with Flechsig in distinguishing sensory from association centers; he does not, however, insist upon the absence of projection fibres from the latter as their characteristic point of difference. On the other hand, he describes in the sensory areas a specific terminal plexus of centripetal fibres ending, in the Rolandic area, in the neighborhood of the medium pyramidal cells.

It has been mentioned that Flechsig recognized a real difference in function between the precentral and postcentral convolutions, pointing out as well structural unlikeness. Hammarberg was of the opinion that in the upper part of the motor zone, the convolutions separated by the fissure of Rolando were histologically similar. Cajal has demonstrated that on the contrary the postcentral gyrus is of practically uniform structure

[14] *Textura de las circunvoluciones cerebrales en los maniferos inferiores.* Barcelona, 1890.

[15] *Studien über die Hirnrinde des Menschen,—Die Bewegungsrinde,* übersetzt von Dr J. Bressler, Leipzig, 1900.

throughout, which is essentially different from that of its neighbor in front. The specific sensory end plexus which Cajal describes is found in the precentral but not in the postcentral convolution, which also in other respects resembles the association areas. The differential characters of these two convolutions mentioned by Cajal will be discussed later in connection with our own observations. Thus far Cajal has considered minutely three cortical centers, the occipital, Rolandic, and temporal convolutions, discovering in each peculiarities of structure which seem specifically adapted to their individual function, and by which they can be recognized and distinguished microscopically.[16]

Such in brief are the epochs in the history of cortical localization and the methods by which it is being worked out. Flechsig is perhaps its extreme advocate. He does not allow the possibility of functional substitution but holds to the doctrine of specific localization of function, the inevitable expression of inherent regional differences in structure. From the first this teaching has had its opponents among both physiologists and anatomists. The deductions of Gall and his predecessors suffered severely from the position taken by Flourens,[17] who taught that the theory of functional localities in the brain was untenable and that all parts of the cortex had precisely the same significance. The views of Flourens found acceptance with many observers and cast a cloud of skepticism over the findings of regional brain physiology which endured for many years. The chief opponent of the work of Hitzig and Ferrier was Goltz. This investigator declared as a result of extirpation experiments on the dog's cortex that the effect of a lesion depends upon the *amount* of cerebral substance which is involved rather than its *location*. Goltz removed brain areas by means of the "flushing out" method devised by himself, and which Hitzig holds to be of little value as a means of determining the functional value of definite localities, inasmuch as it cannot be said to produce strictly local lesions. Goltz' work showed the phenomena of consciousness were the result of functioning of the entire cerebral cortex, without however invalidating the fundamental conception of anatomic localization.

[16] *Die Schrinde*, 1899; *Die Bewegungsrinde*, 1900; *Die Hörrinde*, 1902; übersetzt von Bressler.

[17] *Examen de la Phrenologie*, 1842.

Loeb[18] strongly supports the views of Goltz, and lifts up his voice against the standpoints of Hitzig on the motor centers, of Munk on the visual centers, and of Flechsig on the association centers. He is inclined to admit an anatomical localization in the cortex "to a certain extent," and yet he asserts that "the only specific function of the brain, or certain parts of it, which we have been able to find is the activity of associative memory."

Psychic localization is explicitly denied. Regarding the belief of many observers that the higher intellective faculties have their seat primarily in the frontal lobes, Loeb remarks, "I have repeatedly removed both frontal lobes in dogs. It was impossible to notice the slightest difference in the mental functions of the dog. There is perhaps no operation which is so harmless for a dog as the removal of the frontal lobes."[19] In the same chapter the author says, "A dog that has lost the anterior halves of both cerebral hemispheres has a tendency to run with its head bent down. A dog which has lost the posterior halves of both hemispheres shows the opposite tendency. It moves very little and its head is carried high in the air; while dogs after the loss of the anterior halves of the cerebral hemisphere often become irritable and ugly; dogs which lose the occipital halves of both hemispheres invariably become good-natured and harmless."[20] To one not acquainted with the author's technique these statements are at least confusing. Moreover it is difficult to understand why psychic localization in man should be unconditionally denied as a result of experiments upon dogs. Bianchi from extirpation of the frontal lobes in *monkeys* comes to an opposite conclusion from that of Loeb with regard to the seat of intellective activity. The results of the enormous work of Flechsig on the development of the *human* cortex Loeb dismisses with the remark, "I have removed the cortex of Flechsig's 'centers of association' in dogs without having noticed anything that justifies Flechsig's hypothesis." What Flechsig's hypothesis is concerning centers of association *in dogs* is not clear.

The view-point of histologic differences Loeb holds to be of little value in the differentiation of brain functions. Kölliker

[18] *Physiology of the Brain*, 1902.
[19] Loeb, loc. cit., p. 257.
[20] Loc. cit., p. 264.

also regards the structural dissimilarities of various cortical areas to be of little significance.

It has been said that Flourens located the motor centers exclusively in the corpora striata. This erroneous view has been championed by Luciani and Tamburini.

The cortical areas which are now recognized to be definitely connected with voluntary movements occupy the region of the fissure of Rolando but have no fixed or constant boundaries. In the lower vertebrates they cover a relatively wider extent of brain surface than in the primates and man.[21] The sulci do not mark the boundaries of functional zones as Schäfer [22] pointed out.

Charcot and Pitres [23] from clinical observation of a hundred and eighty-five patients with various forms of paralysis, together with post-mortem section, concluded that the motor zone comprised the *ascending frontal, ascending parietal and paracentral gyri*, the orbital, prefrontal, occipital, superior and inferior parietal and temporo-sphenoidal lobes being non-motor.

According to Barker [24] the motor area is made up of the *anterior and posterior central, the bases of the first, second and third frontal, and the paracentral*, corresponding to the Körperfühlsphäre of Munk and the Tastsphäre of Flechsig.

Obersteiner [25] reckons the *anterior and posterior central, paracentral, base of the third frontal and the anterior portion of the superior parietal* as belonging to the motor area. Text-books in general figure both central convolutions as representing the centers for voluntary movements.

In 1887 Beevor and Horsley [26] suggested that the precentral convolution was much more definitely concerned in motor phenomena than the postcentral. This view has found increasing favor. Tschermak [27] experimenting upon anthropoid apes finds

[21] Cf. the original statement of Hitzig regarding the dimensions of the motor cortex. Also the findings of Beevor and Horsley and Sherrington and Grünbaum in apes and monkeys.

[22] Festschrift zu Karl Ludwig, Leipzig, 1887.

[23] From Rev. de Méd., 1883. Ref. Brain, VII, p. 270.

[24] The Nervous System, 1899.

[25] Nervöse Centralorgane, 1901.

[26] Phil. Trans. Royal Society, CLXXVIII.

[27] Congress of Physiologists, Turin, 1901.

that only the precentral convolution gives unquestionable motor responses. Especially important is the work of Sherrington and Grünbaum.[28] These investigators experimented upon all known species of anthropoid apes, using the galvanic current for stimulating the cortex. Most of their observations were made upon the chimpanzee. As a result of their experiments they draw the following conclusions regarding the motor cortex.

The motor area includes the entire length of the precentral convolution and usually the whole of its width. It extends to the bottom of the fissure of Rolando occupying its anterior wall and in some places its floor, occasionally even reaching to the deeper part of its posterior wall. It never reaches the free surface of the postcentral gyrus. Anteriorly there is no fixed limit. It dips into the precentral sulcus to a varying extent or may exceed it. Superiorly the motor zone extends on to the mesial surface of the hemisphere but does not reach the calloso-marginal fissure. Confirmatory results were obtained by these experimenters with the orang, and also with the gorilla which stands nearest to man in the order of primates. They found further that destructive lesions in the precentral convolution were invariably followed by paralysis and descending degeneration, while similar or even larger lesions in the postcentral were followed by no such results.

Probst's[29] findings in the pathology of amyotrophic lateral sclerosis furnish additional evidence in favor of precentral localization. This is a disease of motor-conducting paths and can sometimes be traced from cortex to muscle. Probst noted severe involvement of the anterior central, the base of the first frontal and the lip of the second frontal convolutions while the postcentral remained nearly intact.

Cajal's[30] conclusions based upon histologic studies tally well with those of recent clinical, pathological and experimental work. The true motor area according to Cajal embraces the precentral convolution including its upper termination and part of the paracentral lobule, together with the bases of the first and

[28] *Localisation in the "Motor" Cerebral Cortex.* Brit. Med. Jour., Dec. 28, 1901.

[29] Arch. f. Psych., XXX.

[30] *Die Bewegungsrinde,* cit. supra.

second frontal convolutions. His belief that the fissure of Rolando separates "two motor areas of different structure if not of specific histology" recalls the hypothesis of Flechsig, before mentioned, of the functional diversity of these two regions.

THE MOTOR CORTEX.[21]—If a section be taken through both central convolutions at right angles to and including the fissure of Rolando several macroscopic peculiarities are noticed. The precentral considerably exceeds the postcentral in the area of its cross section and differs from it in contour, being roughly wedge-shaped with the base of the wedge inward, while the postcentral is wedge-shaped with the base of the wedge toward the surface. This difference is accounted for by the fact that the central sulcus does not sink perpendicularly into the medullary substance but dips backward in the depths, its bottom lying nearer the occipital pole than its mouth. Thus is formed an anterior convolution whose base is broadened at the expense of the posterior for the accommodation of the large number of coarse pyramidal fibres running through its white matter from the giant cells which are distributed along its summit and sides. Measurements across the summits of the two convolutions from the center of the central sulcus to the centers of the pre- and postcentral sulci do not show exaggerated differences in width; the precentral gyrus, however, in places where the two can be compared by reason of definite limiting sulci, usually exceeds the postcentral by one to three or four millimeters. Measurements deep in the fissure show more pronounced differences and when the bottom is reached the precentral convolution averages twice the breadth of the postcentral. In a formaline brain the average width of the precentral, from superior to inferior termination of the fissure of Rolando and including measurements across the width and base of the cross section, was found to be 15 mm., while the average width of the postcentral was 11 mm.

Corresponding with the inequality in width of the two convolutions is an equally marked dissimilarity in the thickness of the

[21] The material used in these observations was obtained from a number of brains of which two were taken from patients who were the subjects of alienation. The pathological findings in these two cases are reported in the articles by Drs. Paton and Rusk and the one by Dr. Dunton. In neither case was any apparent diminution in number of cells or fibres observed.

grey cortex. This is less noticeable on the surface, although almost invariably the anterior cortex shows an appreciable excess in thickness, but as one follows the sulcus toward the white matter the difference becomes very conspicuous, reaching a maximum at about the mid-depth of the fissure. In this location the precentral cortex may present a thickness two or even three times that of the postcentral. As one turns around the bottom of the fissure to ascend the posterior wall the narrowing of the cortex is quite abrupt. The average width of the precentral cortex from measurements taken at mid-summit, mouth of the fissure, mid-depth, and bottom, from the fossa of Sylvius to the median fissure, was found to be 3.8 mm., the average width of the postcentral cortex being 2.8.

Even more striking than the naked-eye differences are those in the minute anatomy of the two convolutions at corresponding levels, and to these reference will be made after the type of motor cortex has been presented as a basis for comparison.

The motor zone extends from the Sylvian sulcus to the callosomarginal fissure. The cortex is widest in that part of this area which extends on to the mesial surface of the hemisphere in front of the termination of the Rolandic fissure. Here also the deep ganglion cells reach their greatest size—Riesenpyramiden of Betz. This region, which constitutes the anterior portion of the paracentral lobule, may therefore be taken as a type of pure motor cortex, and its description will apply with slight modifications to the entire zone, serving to differentiate it from specific sensory and association areas.

In a section from the anterior paracentral, hardened in alcohol and stained with Unna's polychrome methylene blue, the unaided eye recognizes in the cortex a series of darker and lighter streaks of varying width. Most superficial is the wide molecular layer showing a slightly darker and sharply defined edge owing to the presence here of the dense subpial glia network. Below the molecular layer which stains lightly on account of the few cellular elements which it contains is seen a narrow dark streak fairly well outlined, representing the closely packed zone of small pyramidal cells. Next succeeds a wide lighter area which gradually becomes darker as one approaches the interior, until about the mid-depth of the cortex is reached.

Here a moderately circumscribed dark zone is observed, the external layer of large pyramidal cells. The inner border of this zone is well marked, while externally it blends with the broad field of medium pyramidal cells, except here and there where a definite row of large pyramidal cells is found. Immediately below this level is a narrow band of relative clearing well marked off from the structures on either side, and which can be traced quite around the convolution. It represents the granular zone of the authors (Meynert's fourth layer), which in the motor areas is sparsely occupied, and becomes the more conspicuous from the fact that it is bounded above and below by well developed layers of large ganglion cells. The lowermost of these layers is the most characteristic feature of the paracentral cortex. It contains the giant cells of Betz which can be seen as a line of deeply stained points following the contour of the convolution, continuing uninterrupted over the superior border of the hemisphere into the precentral and first frontal gyri, and disappearing below in the calloso-marginal sulcus. The individual cells are plainly visible and their number can be approximated macroscopically. Below the line of Betz's cells a fine light streak can usually be discerned. It is explained by the relative scarcity of small elements in the immediate vicinity of the giant pyramidal cells. Finally, the undermost layers of the cortex appear as an evenly shaded zone blending somewhat with the slightly stained white substance on the summits of the convolutions, but better differentiated from it in the depths of the fissures where the cortex as a whole is considerably narrower and its composing elements more condensed.

Weigert preparations show the characteristic fibre picture of the motor zone. In these also the chief structural peculiarities are recognized with the naked eye. Just under the pia a dark line indicates the site of the tangential fibres which are particularly numerous in the paracentral lobule. Nearly the upper half of the cortex is occupied by a zone which takes up but little stain—supraradiary zone of Edinger—containing the specific end-plexus of exogenous fibres—*Schalt-plexus* of Cajal. This zone is limited below by a dark narrow band composed of horizontal fibres—Baillarger's outer stripe—below which the tissue takes a much deeper stain owing to the increasing number of

radial bundles of nerve fibres between which lies the interradiary network of Edinger. A little more than midway from Baillarger's outer stripe to the medullary substance a similar but less distinct concentric marking is visible, occupying the neighborhood of the giant pyramidal cells. This is Baillarger's inner stripe or the outer association band. The cortex is thus roughly divided into two nearly equal laminae, an outer faintly staining layer external to the superficial large pyramidal cells and an inner darker zone, the two being separated by the outer stripe of Baillarger.

The following description is based on the examination of sections stained with hematoxylin and eosin, Nissl's methylene blue, Unna's polychrome methylene blue, and by the Weigert-Pal method. For a more detailed histology, particularly with reference to dendritic branchings and the fate of the axis cylinder as revealed by the Golgi method, reference must be made to Cajal.

Cell Distribution of the Paracentral Lobule.

Cellular elements are found in the cortex from the outermost to the innermost border, lying immediately beneath the pia-arachnoid and occurring between fibre bundles where cortex and medulla blend. In these extreme positions only neuroglia nuclei are seen, although the ganglion cells occupy nearly as wide a territory.

Molecular Layer.—This zone is characterized by the paucity of contained cells, particularly ganglion cells. Underlying the pia is seen a very narrow band staining a little more deeply than the remainder of the molecular layer and made up of glia network. It contains no nervous elements but numerous neuroglia nuclei, some of which lie on the free surface adjacent to the pia. Below this level ganglion cells are irregularly distributed. They vary greatly in size, the smallest being but slightly larger than the small neuroglia nuclei, while the largest types may be four or five times as large. Of the smallest forms no more can be seen than a vesicular nucleus with eccentric nucleolus, and partial or complete perinuclear chromatin ring, with a narrow wisp of protoplasm at one or more points. No processes can be followed and no Nissl bodies are to be seen.

Occasionally a fold in the nuclear membrane presents. Some of these minute forms with almost no visible protoplasm are with difficulty distinguished from neuroglia nuclei, which also vary somewhat in size and in depth of staining, the smaller being darker. Cajal mentions as differential points the larger size of the nucleus in the ganglion cell, the presence of the chromatin ring which he considers intranuclear, and the occurrence of a well-formed nucleolus. The glia nuclei, however, also contain nucleoli, sometimes a single large one, and they frequently present a dark contour. Morphologically it may be all but impossible to determine whether certain forms are glia or nerve cells. In a successful polychrome preparation the two varieties can usually be recognized by their staining reaction, the ganglion cells staining deep blue with a distinct purple tinge, while the neuroglia nuclei present a faint greenish cast; although this criterion does not serve in every instance, the difference is often striking when a nerve cell is closely surrounded by several glia nuclei, a relation which all types of nerve cell present at all levels in the cortex.

As the nerve cells of the molecular layer increase in size they decrease in numbers. The large forms are conspicuous but rare. They lie indifferently high or low in the layer, and one may now and then be seen in contact with the submeningeal glia zone. They possess a considerable cell body of irregular triangular, stellate, spindle, or rarely pyramidal form, whose branching processes can occasionally be followed two or three cell-diameters. The nucleus usually occupies the greater portion of the cell but not always, and chromophilic particles in the surrounding protoplasm are plainly visible. Among the larger elements a spindle-shaped cell here and there occurs, sometimes with its long axis parallel with the surface of the convolution and again at a right or oblique angle with it. Some of these forms evidently correspond with the autochthonous horizontal cells of Cajal.

True pyramidal cells are not found in the molecular zone, and although an occasional large cell assumes this form, the characteristic descending axis-cylinder of the pyramidal cell with its achromatic cone of origin cannot be demonstrated. Lipochrome is not observed in the cells of this layer.

Sections stained after the Weigert-Pal method show a rich tangential system whose fibres present considerable variation in size. The finer strands run horizontally or obliquely, forming a loose network but tend more and more to assume a course parallel with the surface as the higher levels are reached. The calibre of these fibres varies somewhat, those representing the terminal branches of pyramidal cells in proportion to the distance of their underlying cells of origin.

The most conspicuous elements in the tangential system are the coarse varicose fibres which stretch across the field and can in some instances be followed for several millimeters without appreciable reduction in thickness. Their size is usually out of all proportion to that of the various branches of exogenous fibres, and they belong, according to Cajal, to the specific horizontal cells of the plexiform layer, first described by him in small mammals and by Retzius in man. Occasionally a thick ascending fibre is seen turning into the molecular layer which suggests the interpretation of Kölliker and others that the coarse horizontal fibres have their origin in the lower levels of the cortex or in the white matter. Cajal believes that they represent a system of superficial association fibres, " nicht nur zwischen getrennten Zonen *einer*, sondern auch benachbarter Windungen," and their unusual length seems to justify this view. Besides the autochthonous fibres and the terminal ramifications of the underlying pyramidal cells, the plexiform layer contains the end processes of cells with short axis cylinders from the upper layers of the cortex, the axone terminations of Martinotti's cells and fibres rising from the medullary substance.

Second Layer—Small Pyramidal Cells.—This well circumscribed zone contrasts strongly with the one just described. The cells are numerous and closely packed, and the separating line between the two layers can be sharply drawn. On the medullary side the line of demarkation is much less distinct, the pyramidal cells increasing in size and the smaller cells decreasing in number as the third layer is entered. In thickness the second layer nearly corresponds with the first, averaging about 0.2 mm.

In comparing the cell elements of the two laminæ one finds that the smallest forms in the second approximate in size the largest of the first, and that whereas in the molecular layer the large

types are very rare, the small cells of the second layer which somewhat resemble them are extremely numerous, especially in the upper part where the two layers meet. There is, moreover, the added type of neurone, the typical small pyramidal cell which characterizes the zone and which occurs most frequently in its lower levels. The second layer may therefore be divided into two, an upper characterized by an excess of small cells with insignificant cell body, and a lower in which larger forms predominate, particularly the pyramidal cell.

The small cells present a nucleus slightly larger than that of the glia cell, staining less deeply and showing the differential color reaction above mentioned. They possess a nuclear membrane which may contain a fold, with partial or complete chromophilic ring, a distinct nucleolus, and suggestions of a protoplasmic cell body with processes which however cannot be followed. Rarely a bipolar form with somewhat elongated nucleus is seen, lying with its long axis vertical or occasionally horizontal or oblique. The larger cells assume a variety of forms, although no more perhaps than are seen among the large cells of the fourth or sixth layer. Triangular, polygonal and irregularly rounded forms occur, and all stages of approach to the true pyramidal cell are met with.

The latter, scattered throughout the zone, are more numerous in the lower two-thirds and present all the essential characters which distinguish the giant cells of a lower level. They possess a roughly triangular cell-body containing a number of chromophilic particles, often a well-defined nuclear cap (Kernkappe), or a lateral clump of chromophilic elements (Schlüsselchen); a round or oval central or eccentric nucleus with membrane sometimes folded (Längsfalte), and nucleolus; a capital process, basal dendrites and descending axone with achromatic cone of origin. As compared with the giant cells, the nucleus is disproportionately large in the small pyramidal cells. Not infrequently the pyramidal cells are tilted at various angles even to 90 degrees, so that the cell appears to be lying on its side; very rarely an element appears with apical process descending and base uppermost. Now and then a small pyramidal cell seated in the upper margin of the second layer gives off a capital process which can be traced for some distance into the

molecular zone. The typical cell with protoplasm, rich in chromophilic particles, is relatively rare in comparison with the great number of triangular or polygonal cells of smaller or equal size in which but a few fine particles or an occasional chromatine clump can be demonstrated.

Fat pigment is now and then found in the small pyramidal cells.

THIRD LAYER—MEDIUM-SIZED PYRAMIDAL CELLS.—A noticeable thinning out of the cell elements marks the transition from the second to the third layer, coincidently with a progressive increase in size of the pyramidal forms which occur in the latter almost to the exclusion of the other types, although a few small irregular vertical fusiform cells are still met with. The width of this layer in the paracentral and motor area generally is its characteristic feature. It is the widest zone in the cortex, and the one whose greater development in the precentral convolution accounts chiefly for the marked difference in the depth of the grey matter between the two central gyri. The average width of the third layer in the paracentral is about a millimeter. As the lower levels of the zone are approached the pyramidal cells become larger and more widely separated from each other, the processes become more conspicuous both in number and size, and assume more and more the characteristic distribution. The apical dendrite can sometimes be followed five or six cell-diameters in good polychrome specimens. One or more neuroglia nuclei are frequently found in the pericellular space. It is among the middle-sized pyramidal cells, according to Cajal, that end the specific centripetal fibres of the sensori-motor area, forming a plexus which he suggests may form the substratum of touch, pain and temperature sensibility.

FOURTH LAYER—SUPERFICIAL LARGE PYRAMIDAL CELLS.—In those parts of the paracentral which exhibit a well developed sixth zone rich in giant cells, the fourth layer has an inconstant value, the two layers being in general in inverse proportion to each other in extent, cell content, and size of the individual elements. The stratum of superficial large pyramidal cells occupies a level somewhat above the mid-depth of the cortex. In places a definite row of large cells is visible contrasting well with the smaller forms of the layer above, while elsewhere they

gradually increase in size through the third and fourth zones and no line of separation can be drawn. The clear spaces are always larger in this region than higher in the cortex, owing to the greater extent of dendritic ramifications characteristic of the larger cells. Lipochrome is more commonly observed as the cells become larger. In appearance the fourth layer type closely resembles the Betz' cell of the sixth except that it is much smaller; indeed a superficial large cell of any considerable size is never seen in the same vertical section with Betz' cells. A common observation in the smaller pyramidal cells of all levels is to find the chromophilic substance clumped at one place, around the nucleus or at some point in the periphery of the cell, most often along the base especially in the vicinity of the axis-cylinder cone and the lateral basal dendrites. A considerable nuclear cap is frequently apparent.

Fifth Layer—Granular Zone.—In the anterior paracentral and precentral gyri this layer is poorly defined. On going through the cortex from the periphery toward the white substance one notices on reaching the fourth layer an irregularly distributed increase in the number of small cells which become more numerous as the level of this zone is passed. Between the superficial and deep pyramidal cells a considerable interval presents 0.2 mm. to 0.5 mm. or even more, in which several cell types occur, including occasional medium and large pyramidal cells. No sharp separating lines can be drawn, however; the boundaries of the fourth, fifth and sixth layers are indeterminate and overlap. Scattered widely therefore between the third and sixth layers, but more concentrated below the fourth, occur the so-called *granules* of the authors. They consist of minute pyramidal and spindle forms, but more characteristically of small irregularly rounded, oval or polygonal cells with insignificant cell body and poor in chromophilic substance, possessing usually only a perinuclear ring which may be incomplete or absent. The small pyramidal and granule cells of this layer correspond in appearance with those of the second. Cajal has shown that the granule cells possess short ascending axis cylinders, ending at various levels, some reaching the plexiform layer (Martinotti's cells), and others stopping at the second, third or fourth zone. He believes that they have a specific associative function and

concludes that the fifth or granule layer "ein intermediärer Bestandtheil der Hirnrinde ist, in welchem sich die Zellen mit kurzem Axencylinder d. h. die intracorticalen Associationszellen concentriren."[32]

SIXTH LAYER—GIANT PYRAMIDAL CELLS.—The pyramidal cell is the predominating type throughout the grey substance. It attains its greatest size and complexity of structure in the sixth layer of the motor cortex. A more careful consideration has therefore been reserved for this specific element, the Betz cell of the paracentral lobule.

Our knowledge of the internal morphology of neurones has largely accumulated since the publication of Nissl's method of staining in 1885. This method distinguishes the chromophilic elements (Nissl bodies) from the achromatic fibrillar constituents of the cell, and until the appearance of the work of Apáthy on the conducting elements in 1897, formed the only basis for the determination of the finer ganglion cell pathology.

CHROMOPHILIC ELEMENTS.—During the developmental stage Nissl bodies are first seen as a few scattered deeply-staining clumps at the periphery of the cell, the body of which stains a lighter even blue (soluble chromophilic substance). Van Biervliet,[33] who has studied the evolution of the chromophilic substance in the anterior horn cells, states that the first definite Nissl bodies appear at the third month of intrauterine life. Their development is centripetal and at the fourth or fifth month the cell presents an appearance closely resembling that of the adult cell during well-marked axonal reaction, and which van Gehuchten therefore termed *physiologic chromolysis*.[34] The nucleus occu-

[32] Cajal, loc. cit., p. 61.

[33] *La substance chromophile pendant le cours du développement de la cellule nerveuse.* Nevraxe, I, 1, 1900.

[34] The normal adult cells of Clarke's column show a characteristic central chromolysis suggesting that of the embryonic horn cell of the fourth month. That this is a normal condition in Clarke's cells was pointed out by Marinesco (Revue Neurol., Octobre 30, 1899). The fact that these cells are of later development that the anterior horn cells, appearing first at the fourth month (Obersteiner), when the latter exhibit the typical peripheral ring of chromophilic particles (Randschollenkranzbild), suggests the possibility that the cells of Clarke's column may afford an example of the persistence of an embryonic type in the adult. If the observation of

pies an excentric position and there is a central clear zone of soluble chromophilic substance in which Nissl bodies have not yet been laid down. At term the nucleus is central and Nissl bodies fill the cell, the faint blue background, which shows between them, indicating that the soluble substance has not been completely used up. In the normal cell of adults the ground substance can be nearly or entirely bleached, showing that the soluble chromophilic substance which is present during the entire embryologic stage disappears with the maturity of the cell. From these and other observations, notably the pathological changes occurring in the *distance-reaction*, Nissl, v. Gehuchten, Lugaro, Marinesco and the majority of authors have concluded that the chromophilic particles represent the reserve nutrient constituents of the cell. They are probably composed of nucleo-albumen.

Nissl resolves the chromophilic particles into masses of very fine granules and describes delicate filaments radiating from them. The masses are ragged in outline and in form and arrangement conform to the limiting conditions of the cell periphery or nucleus to which they may be adjacent. Thus along the borders of the cell they are elongated and disposed in more or less parallel rows, while toward the center the clumps become more rounded and compact and are distributed concentrically about the nucleus, the innermost forming the perinuclear ring which is separated from the nuclear membrane by a very slight but appreciable interval, the perinuclear space. A considerable aggregation of chromophilic elements is usually observed at some point of the nuclear periphery, most commonly perhaps at the top, forming a crescentic cap (Kernkappe). It may also occur at the base or one side, sometimes giving the nucleus an indented or reniform aspect. In the capital process and basal dendrites the stainable substance appears as elongated bands which can be followed as far as the processes are visible, becoming narrower and longer in proportion to the distance from the cell. A roughly triangular clump marks the place where a

Schacherl (Obersteiner's Arbeiten, VIII, 1902), that in embryos the bodies of Clarke's cells are completely occupied by Nissl bodies is correct, we have here a curious instance of the reverse order of development of two types of cell of different function.

process is given off from the cell body or where a bifurcation of a dendrite takes place (Verzweigungskegel, cone de remplissage of Benda, bifurcation cone of Nissl). The axis-cylinder and its cone of origin contain no chromophilic particles.

LIPOCHROME.—In the cortical cells, this is present as the light yellow variety in contradistinction to the dark brown pigment of the locus cæruleus and substantia nigra. It is a normal constituent of all types of nerve cell which have undergone a certain degree of functional activity, representing an end product of cell metabolism and derived, according to Marinesco, from broken-down Nissl bodies. Fat pigment is absent in the new born. appears in the spinal ganglion cells at the sixth year (Pilcz[35]), in the anterior horn cells at the eighth year, and in the cortex somewhat later, increasing during the life of the individual. Marinesco states that the pyramidal cells do not show pigmentary degeneration before the twentieth year. That it occurs much earlier there can be no doubt, as can often be demonstrated in osmic acid preparations at about the beginning of the second decade (Obersteiner). Rosin[36] dates the first appearance of pigment at about puberty. We have observed it in the cortex of a negro girl of eleven who died following operation for Jacksonian epilepsy. Fatty metamorphosis is always associated with a local disappearance of the Nissl bodies. In sections stained with methylene-blue it shows first as a faint yellow sheen between the chromophilic particles which present perhaps but the slightest traces of disintegration. Soon, however, fragmentation takes place and a circumscribed clump of fat-pigment granules may be seen, lying in any part of the cell, preferably near the base and at a distance from the nucleus. In other instances a considerable degree of chromolysis may be present without the appearance of lipochrome, or it may develop late in a chromolytic area. There is doubtless a difference in the significance of these two processes. The first, which may be called primary pigmentation, represents possibly the normal local involution of the nutritive elements; the pigment appears early in the regressive change and does not show a tendency to marked

[35] *Beitrag zur Lehre von der Pigmententwickelung in den Nervenzellen.* Obersteiner's Arbeiten, III, 1895.

[36] Virchow's Archives, 162; v. Neurol. Centralbl., Aug. 1, 1901, S. 712.

and rapid diffusion. In the other case, secondary pigmentation, the process is later and attacks the chromophile substance during functional activity, but when it has reached a stage where separation is no longer possible. Secondary pigmentation is then likely to be rapid and diffuse. Pigment is never seen in the nucleus, and this structure migrates to that portion of the cell where the Nissl bodies are best preserved and farthest from the breaking-down area, between which and the nucleus a dense compensatory clump of chromophilic elements is frequently seen skirting the nuclear membrane and apparently walling off the trophic center of the cell from the advancing destructive process."

ACHROMATIC SUBSTANCE.—This includes that portion of the cell-body which does not stain by Nissl's method. It contains at least two essential structures, (1) the conducting elements of Apáthy, primitive fibrils of Bethe, and (2) the unorganized supporting substance, trophoplasm of Marinesco.

The fibrillar structure of the ganglion cell, first recognized by Max Schultze in 1868, has become an almost universally accepted fact. By the methods of Apáthy, Donaggio, Bethe, the chromophilic substance of Nissl is left unstained while the achromatic substance takes up the color and its structure is more or less perfectly revealed. That fibrils may enter the cell by one of the processes and course independently through it without branching or anastomosis, to leave by another process or the axis-cylinder, is amply shown in Bethe's preparations. This author has also observed a centripetal fibril of a basal dentrite turn sharply around the point of bifurcation of the latter to become at once a centrifugal fibril without entering the cell-body at all. This occurrence has also been described by Vogt.[11] Nissl supports the view of Bethe that the primitive fibrils are anatomically independent of the ganglion cells, and run uninterruptedly through them. On the other hand, Apáthy describes an intricate intracellular anastomosis of the entering fibrils which

[10] It is generally stated that pigment is observed in the various large types of nerve cells except the cells of Purkinje, in which it has not been found. Rusk (Amer. Jour. Insanity, July, 1902) has recently described traces of pigment seen by him in Purkinje's cells from a case of Huntington's chorea.

[11] Centralbl. f. Nervenheilk. u. Psych., Dec., 1901.

suggests that conduction must in some way be altered or influenced as the fibrils pass through the cell-body. This view is shared by Marinesco, van Gehuchten, v. Lenhossék, Lugaro, Cajal, Donaggio and others. Donaggio[11] has recently given an account of a system of secondary fibrils shorter and finer than the primitive fibrils of Bethe and occurring between the meshes of the intracellular reticulum.

The methods of fibril staining are all very tedious and complicated and cannot be said as yet to have yielded constant results. The origin, intimate disposition, mutual relations and ultimate fate of the primary fibrils of the nervous system are still unsettled questions. It is thus an unfortunate fact that most of our information on the histology and pathology of the nerve-cell concerns itself with what is presumably the lesser important of the two prime constituents; the majority of our descriptions are based upon findings by the Nissl method or some similar process by which the nutritive elements are revealed, while those which have to do *par excellence* with nervous function, the conducting elements, remain entirely undiscerned.

Levi (1896) discovered a constituent of the trophoplasm which shows this substance to be the seat of marked chemical activity during function. By means of an acid fuchsin and methylene-green stain he found that during fatigue there was an excess of granules in the cell which took up the fuchsin, while during recuperation these granules decreased in number and were replaced by granules having an affinity for the methylene-green, the latter being greatly in excess during repose.

No limiting membrane has been demonstrated for the nerve-cell. The marginal portion, however, differs from the rest of the cell in its chemical reaction, is more resistant to maceration, according to Martinotti, and the Nissl bodies in this location Marinesco believes to have a greater endurance. The three cell-zones, peripheral, central, and perinuclear, undoubtedly possess peculiar characteristics, both chemical and histologic, and perhaps functional. They present peculiarities of structure as regards both Nissl bodies and fibrillar elements.

Canalicular System.—Adamkiewicz was the first to de-

[11] Rivista Sper. di Fren., 1901, 27.

scribe intracellular spaces or canals. These he observed in the spinal ganglion cells and considered to be lymph spaces. Holmgren confirmed the views of Adamkiewicz and described the connections between the endocellular canals and the pericellular lymph space. Holmgren also observed processes of stellate glia cells entering the peripheral canals. Donaggio[40] has lately studied the intracellular canaliculi. He describes a fine network of canals, taking often a wavy course, and maintaining a connection with the perinuclear lymph space into which he has seen two or three delicate canaliculi opening. Fragnito's[41] view of the pluricellular origin of the ganglion cells accounts for the canals of Holmgren, as the spaces left between the approximated neuroblasts which go to make up the neurone.

THE PROCESSES of the giant pyramidal cells are particularly large and richly branched. They represent gradually narrowed off portions of cell protoplasm in contradistinction to the axis-cylinder which springs abruptly from its cone of origin situated at some point of the cell-base or occasionally on one of the large dendrites near the cell, and maintains a uniform calibre throughout, while the dendrites become progressively smaller from frequent subdivision. His (1889) taught that the neuraxon was the first process to develop in the neuroblast. Bechterew (1899), Paton[42] (1900), Hatai[43] (1902), showed that the dendrites and not the axis-cylinder process are the first to appear. The capital process constantly develops much earlier than the basal dendrites, and keeps its integrity for a considerably greater distance from the cell, the lateral processes usually dividing dichotomously. The constant difference in the time of development and in the mode of distribution of the two characteristic cell-processes, apical and basal, suggests an inequality in importance and dignity of function. The apical process appears early and is a more integral part of the cell. Its terminal ramifications are destined exclusively for the plexiform layer. The basal processes appear late and send their branches into the same layer in which the cell lies or to lower levels.

[40] Riv. Sper. d. Fren., 1900, 26, p. 188.
[41] Annal. di Nevrologia, 1900, XVIII, 6, p. 433.
[42] *The Histogenesis of the Cellular Elements of the Cerebral Cortex.* Baltimore, 1900.
[43] Jour. Comp. Neurol., June, 1902.

THE NUCLEUS of the large cells is regularly round or oval and centrally situated as distinguished from the eccentric nucleus of many of the smaller types. It possesses an enclosing membrane, a reticulo-granular structure and a central deeply-staining nucleolus, around which a narrow clear space can be demonstrated, the *perinucleolar* space. From this can usually be traced five or six light radiating lines, suggesting the *perinuclear* space and canaliculi of Donaggio. Chemically the periphery of the nucleolus differs from its interior, having an affinity for basic stains, while the central portion is acidophile (Levy). Within the nucleolus may be seen several darker points (endonucleoli of v. Lenhossék). Almost constantly the nucleolus exhibits one or several light areas (Obersteiner's nucleololi). There may be one central nucleololus or two or three irregularly disposed, usually rounded in outline. Occasionally one is observed on the limb of the nucleolus. In this location the nucleololus may be seen to exceed the limits of the nucleolus, lying partly within and partly without and bounded externally by an extremely fine dark line—the nucleololus thus presenting the appearance of a minute vesicle. The smaller pyramidal cells frequently show a conspicuous fold in the nuclear membrane (Längsfalte). This cannot be demonstrated in the giant cells. Nissl [4] calls attention to the constant appearance of the membrane fold in certain types of cells and its absence from others in the normal condition. "Auch unter pathologischen Verhältnissen wird man es niemals in solchen Zellen, die es in der Norm nicht zeigen, antreffen."

The giant pyramidal cells tend to arrange themselves in pairs, threes or small groups, the groups being separated by radial fibre bundles. Two or three cells are frequently disposed *en échelon* or superimposed one above the other. In external morphology they show considerable variation, the most constant difference being seen if one compares cells from the summits of the convolutions with those in the depths of the sulci. In the former situation the typical pyramidal form predominates, and the vertical axis constantly exceeds the horizontal, while in the sulci broad polygonal and polymorphous types are characteristic.

[4] Centralbl. f. Nervenheilk. u. Psych., 15 April, 1902, p. 255.

The other forms described, small and medium-sized pyramidal cells, granule cells and fusiform cells are also met with in the sixth layer.

Seventh Layer—Polymorphous Cells.—Below the level of the giant cells a narrow zone can often be seen in which there are relatively few stained elements, the space being occupied by dendritic ramifications. Below the clear area occur numerous smaller forms of the pyramidal cell, together with oval, triangular and polygonal varieties. In all of these, as in the smaller types universally, the nucleus usually occupies the greater part of the cell-body. Granules are occasionally seen. Especially numerous in this layer are the fusiform cells with ascending and descending protoplasmic processes. They vary considerably in size, the largest lying higher. The nucleus is often elongated, the nuclear membrane showing a fold parallel with the long axis of the cell. The course of the processes is sometimes oblique. Cajal has observed in this zone occasional large stellate cells with horizontal processes, which he concludes are to mediate long-distance association. Fat pigment is found in the cells of the seventh layer.

Eighth Layer—Spindle Cells.—The radial arrangement of cells which can in many places be traced through the cortex into the layer of small pyramidal cells becomes more conspicuous in the lower zones and is best shown in the spindle cell layer. While no sharp dividing line can be drawn between the seventh and eighth zones, in the former the cells are larger and more numerous and the triangular and polygonal forms predominate, while in the eighth layer the cells become progressively fewer as the white matter is approached, the intercellular spaces are wider, the cells are smaller, and spindle forms exceed all other types. Small triangular and stellate cells may still occasionally be seen. For a variable but considerable distance between the fibre bundles of the medullary substance, long narrow fusiform cells can be traced. The nucleus is elongated, the cell-body slight and without formed Nissl bodies.

In Weigert preparations, as one traces the fibres from below, it can be seen as soon as they are distinguishable above the densely-staining medullary zone that they assume three general directions, vertical, horizontal and oblique. The great mass of

coarse fibres from the centrum semi-ovale is collected into loose radial bundles which assume a straight course through the cortex and can be followed to the lower levels of the third layer, where they lose their myeline and are no longer visible. Between the radial bundles, and sometimes running with them, are finer strands which take different courses, oblique or horizontal, but which cannot be followed beyond the lower cortical levels. Coarse oblique fibres can also be seen emerging from the depths and running with unchanging course as far as the eighth or seventh zone. Horizontal fibres are present at all levels of the cortex, but are more thickly collected in two, occasionally three, transverse bands—the tangential system—and the outer (and inner) stripes of Baillarger. The tangential fibres of the molecular layer have already been referred to. They are especially numerous in the paracentral and precentral convolutions, owing to the large number of end branches from the underlying large pyramidal cells which penetrate the molecular zone and there take a horizontal direction, thus giving the zone an unusual width in these regions.

Obersteiner states that the outer stripe of Baillarger (Gennari's band), lies in the lower portion of Meynert's third layer and that it is chiefly composed of collaterals from the axis-cylinder processes of the pyramidal cells. According to Cajal, the horizontal fibre plexus in the zone of medium-sized pyramidal cells corresponds with the upper part of the specific end plexus of exogenous fibres described by him as characteristic of the sensori-motor cortex, which in all mammals may therefore be recognized in "dass sie ein dichtes Geflecht von sehr dicken exogenen Fasern hat, welches in Niveau der mittelgrossen Pyramiden, d. h. oberhalb der äusseren grossen Pyramiden liegt."[a] This plexus Cajal found in the precentral and bases of the first and second frontal but not in the postcentral convolution. It is best seen in the fœtus of seven or eight months before myelinated fibres have obscured the field. He describes it as composed of three zones—lower, middle and superficial. In the first, which includes the meeting place of cortex and medullary substance, the fibres take a vertical or diagonal course,

[a] Die Bewegungsrinde, p. 81.

crossing the radial bundles at various angles; in the middle zone they assume a horizontal direction; in the uppermost they are broken up into a fine plexus which occupies the whole of the third layer of the cortex, even extending into the lower portion of the layer of small pyramidal cells. Most of the finer branches possess no myeline sheath, hence the relative clearing in the third layer in Weigert preparations. The coarser fibres in the lower part of the superficial zone of Cajal's plexus are myelinated, however, and "dieser markhaltige Plexus ist nicht Anderes als der von den Autoren sogennante Gennari'sche Streif, die Lamina medullaris externa (Kölliker, etc.)."[*] Sometimes a second ill-defined transverse band can be made out in the lower cortical levels, made up of the horizontal processes of Cajal's deep association cells.

The above histologic characters apply to a section of the anterior paracentral, including the upper termination of the precentral and base of the first frontal gyrus.

Between the anterior and posterior central convolutions, constant differences in structure exist by which they can be differentiated either macroscopically or microscopically. The gross differences have already been mentioned. They are best seen by comparing the cortex on the anterior and posterior walls of the fissure of Rolando. In such a comparison the postcentral convolution is recognized by four peculiarities: (1) Its narrowness, the precentral exceeding it in width by a third or a half. (2) Its staining more deeply in the upper half than the corresponding part of the precentral, on account of the denser occupation by small and middle-sized pyramidal cells which in the postcentral are confined within much narrower limits. (3) A narrow, lightly staining zone marking the position of the sixth layer, which in the postcentral contains no giant cells and therefore stains less deeply. (4) A sharper separating line between cortex and medulla. The broad precentral cortex stains more evenly, is less well differentiated from the white substance, and in the upper half of the Rolandic zone shows macroscopically a row of dark points in the deep portion corresponding to the light band in the postcentral and representing the giant cells

[*] Loc. cit., p. 86.

of the sixth layer. With a very low magnification the individual characters of the two convolutions are even more marked, and each of the cortical layers presents distinguishing features. The first and second are noticeably wider in the precentral, the small cell layer being less densely packed. The most marked excess in width is observed in the medium-sized pyramidal cell layer of the precentral, with a corresponding diminution in density of the cell contents. The fourth layer is therefore situated considerably nearer the surface in the postcentral gyrus and its cells are larger and more numerous, particularly on the summit of the convolution. Thus the postcentral resembles the association zones in that its largest cells are situated in the fourth layer, while in the motor precentral the largest cells occur in the sixth layer. All the layers below the fourth are much better defined in the postcentral than in the precentral gyrus. The fifth layer (granule zone) is broad and contains many more small elements, suggesting also in this respect the cortex of the association zones. The sixth layer in the postcentral shows a notable dearth of cell elements, the giant pyramidal cells being entirely absent. A better differentiation is seen between the seventh and eighth layers of the postcentral than in the precentral.

Weigert preparations show peculiarities in the fibre pictures quite as noticeable as those above mentioned for the cells. The radial bundles are thicker and denser and have a longer course above the medulla in the precentral cortex. In the anterior wall of the Rolandic sulcus there are numerous radial fibres, while they are conspicuously few in the posterior wall. The anterior cortex also shows a much richer system of deep horizontal fibres (association fibres by Cajal), the difference being especially marked in the sulcus, where these fibres are extremely few in the posterior central. Baillarger's zone is also better marked and the deep oblique fibres are more numerous in the anterior central. The line in the midcortex where the radial bundles stop is much plainer in the postcentral, owing to the scanty development of a fibre plexus in the third layer, while in the precentral this thick plexus partially obscures the line of termination of the radial fibres. Finally, the tangential layer in the precentral is broader and its constituent fibres are much

more numerous, as would be expected from the fact that these fibres largely represent the upward prolongation of the apical processes of the large pyramidal cells. The extremely coarse strands described in connection with Cajal's autochthonous cells are not observed in the plexiform layer of the postcentral convolution.

In following the fissure of Rolando from its lower to its upper termination one meets with considerable changes in the structure of the central convolutions, all of which, however, are very gradually effected. At the lowermost level of the Rolandic zone, no such striking differences are seen between the pre- and postcentral gyri as obtain higher up. The inequalities in width and differentiation already noted are present but in much less exaggerated degree. No giant cells are found in either convolution. In the precentral an occasional large cell occurs in the sixth layer but the majority are distributed over the fourth and fifth, there being no definite granular zone. In the postcentral, on the other hand, the large pyramidal cells are almost entirely confined to the fourth layer, below which a well-marked granular zone is apparent. The chief point of difference therefore in the cortex of the two convolutions at this level is the better definition of the fourth and fifth layers in the posterior central.

The facial area which is innervated by neurones with relatively short axis cylinders contains no giant cells. These first appear as one ascends the central sulcus at a variable point about a fourth or fifth of the distance from the sylvian to the median fissure, which probably marks the beginning of the arm area. At this level only a few giant cells can be seen. They are situated deep in the fissure near its bottom, in the sixth layer of its anterior wall. No giant cells are present in the anterior cortex on the summit of the convolution. In the postcentral on the contrary the layer of superficial large pyramidal cells becomes much better developed as it emerges from the sulcus to reach the free surface and occasionally on the summit of the convolution or in the anterior wall of the postcentral fissure a very large cell occurs. These cells do not occupy the sixth layer but are always found above the granule zone and do not moreover reach the size of the sixth layer cells of the anterior convolution of the same level. While in general it

may be said that the pyramidal cells of the largest type are limited to the strictly motor cortex (precentral convolution and its antero-superior adnexa), one may nevertheless now and then be found outside of this region, as has been pointed out by Bevan Lewis. In the arm area the precentral cortex assumes an appreciable increase in thickness, due to the progressive development of the layer of middle-sized pyramidal cells. In this area there are, therefore, besides the two differential postcentral characters of the facial area, two additional precentral features, a wide third zone and the presence of giant cells in the sixth layer. Corresponding with the appearance of the latter a rich tangential system develops in the anterior wall of the sulcus, while in the posterior wall it remains very rudimentary, and is also poorly developed on the summits of both convolutions.

Continuing upward through the motor area the cortex becomes progressively broader, the sixth layer cells increase both in size and number, and the place of greatest density both of the giant cells and the overlying tangential fibres is gradually shifted rising out of the sulcus to the free margin of the convolution. In the middle third of the Rolandic region corresponding roughly with the limits of the arm area, the giant cells occupy the entire anterior wall of the fissure, being densest in the upper portion of the area opposite the origin of the superior frontal sulcus. Above this level they gradually spread over the free border of the convolution occupying both summit and fissure. In the latter position they become steadily fewer and in a section including the upper extremity of the central sulcus giant cells are usually found only along the summit of the precentral convolution. Throughout the leg and trunk areas they show a marked increase in size.

The tangential fibres of the precentral cortex always correspond in density with the underlying giant cells, being best developed in the sulcus in the middle third, and on the summit of the convolution at the upper extremity of the motor zone.

As has been mentioned, the structure of the precentral and base of the first frontal continues essentially unchanged into the paracentral lobule. In a vertical section through the middle of the precentral and including the paracentral and callosal gyri, Betz's cells are seen to continue uninterruptedly as far as the mouth of the calloso-marginal fissure, beyond which giant cells

of slightly smaller size can be followed for a variable distance along the superior wall of the sulcus or even to its floor. They are not present in the lower wall or in the gyrus cinguli. If an oblique section be taken from the paracentral so as to include the termination of the fissure of Rolando, Betz cells can be followed to the mouth of the fissure or for a variable distance down its anterior wall but do not occur in the posterior wall.

The anterior paracentral is of practically uniform structure throughout. In the lower portion adjacent to the callosal gyrus the cortex is a little narrower owing to a thinning of the zone of medium-sized pyramidal cells, and the granular layer is slightly more conspicuous. This narrowing of the third layer increases as one passes around the bottom of the sulcus into the cingulum, where the granular zone occupies a relatively high position.

A considerable change in structure is noted between the anterior and posterior segments at the paracentral, and an imaginary vertical continuation of the central fissure over the face of the lobule roughly divides the two segments. Betz cells are confined to the anterior segment and are limited fairly constantly by the imaginary line, on passing which posteriorly the cortex gradually assumes the postcentral type. The third layer becomes narrower, the fifth more conspicuous and higher in the cortex. Fairly large cells are still found in the sixth layer until the lip of the ascending ramus of the sulcus cinguli separating the paracentral from the precuneus is reached. Beyond this point as a rule no large cells are found in the sixth zone while the cells of the fourth assume an increased size. On reaching the surface of the precuneus the cortex is still narrower, the fourth and sixth layer cells smaller and the granular zone much better developed.

The *pli de passage* therefore partakes of the characters both of the precentral and postcentral cortex and the two types are differentiated just as certainly as on the convexity of the hemispheres where they are separated by the Rolandic sulcus. In that part of the paracentral lying below the termination of the sulcus the characteristic postcentral feature, a prominent granular layer, and the characteristic precentral feature, a sixth zone of giant cells, are seen existing together.

All changes in cortical types are effected very gradually, and this is equally the case whether they are separated from each

other by the conditions of the surface configuration or not."[11] The giant pyramidal cells embrace the hemisphere from the callosomarginal sulcus to a point near the lower end of the sylvian fissure, with an approximately vertical zone which is widest in its upper portion. This is the specific motor zone, and behind it exists another zone of different structure and doubtless different function. The central sulcus separates these two zones nearly but not absolutely, while the neighboring fissures are of no significance as functional or histological landmarks. The chief object of the fissures is evidently to furnish increased room in the cortex for expanding incoming fibres and the development of intracortical and association and projection neurones. Fissure formation is earliest stimulated where functional activity is greatest, and this is admittedly in the projection centers. Hence we have three primary fissures, the Sylvian, Rolandic and calcarine, each associated with a specific early function, though not necessarily marking an absolute bound to its area of representation.

The experimental findings of Sherrington and Grünbaum may be referred to again in connection with the question of cell distribution. These observers differ in one noteworthy particular from most of their predecessors, namely, "the extension of the excitable 'motor' region to the free surface of the postcentral convolution. We have seen nothing to lead us to include that surface or any part of it in the 'motor' area of any of the anthropoids we have used." They find the excitable area to include the length of the precentral "and in most places the greater part or the whole of its width. It extends into the depth of the Rolandic fissure, occupying the anterior wall, and in some places the floor, and in some extending even into the deeper part of the posterior wall of the fissure."

On the histological side the general postulate that difference in structure indicates difference in function is applicable to the cortical areas. "Es führt also schon die anatomische Betrachtung allein zu der Anschauung, dass die verschiedenen Rindengebiete des Grosshirns functionell nicht gleichwertig sein können" (Obersteiner). It may be assumed that the true motor area includes

[11] Bevan Lewis showed that in the lower animals the passage from one cortical type to another is abrupt, thus contrasting with the manner of transition in man.

only those portions of the cortex which present the specific elements of the sixth layer. "Dass die grössten pyramiden Zellen an gewissen Stellen bei den motorischen Leistungen eine Rolle spielen, ist sicher" (Obersteiner). These elements increase in size from below upward in direct proportion to the length of their axis cylinder processes. The facial neurones with short axis cylinders are small, the arm neurones are larger, the neurones of the paracentral whose axis cylinders are destined for the lumbar cord are gigantic. Sherrington and Grünbaum do not say where in the precentral gyrus the motor area was found not to occupy the whole of its width. Of the four highest species of primates, the orang-outang, chimpanzee, gorilla and man, they examined the brains of the first three and obtained uniform results in all. It is not unreasonable to suppose, therefore, that the final step in the series would not have broken the chain of evidence. If, accordingly, the cell distribution in man and in the gorilla are comparable, we should expect it to be in the face and arm, particularly the forearm cortex, that the excitable area does not include the entire width of the precentral convolution, for in the lower half of the Rolandic zone the motor cells are nearly confined to the anterior wall of the sulcus, in the lowest levels not even reaching the free surface of the convolution. It is also not stated in what places the excitable area extended to the deeper parts of the posterior wall. This we should expect to be most often the case in the upper mid-portion of the motor zone, for here most frequently can giant cells be followed around the bottom of the sulcus and into its posterior wall, in some instances an isolated cell being found a third or even a half of the way up, in the sixth layer, but never reaching the free surface of the postcentral gyrus, the summit of which is always entirely free from giant cells. It is in this portion of the motor cortex that giant cells show their widest distribution, exceeding the limits of the precentral fissure and extending for a variable distance along the superior frontal gyrus. Two or three may also sometimes be seen in the depths of the postcentral fissure in its anterior wall. It is preeminently in the sulci that motor impulses arise. The giant cells in the fissures far outnumber those on the surface of the brain. Sherrington and Grünbaum found the excitable area to extend on to the mesial face of the hemisphere, without, however, reaching the calloso-marginal

fissure. This latter result we should anticipate in the posterior segment of the paracentral, for in this location no Betz cells are found. In the anterior segment, on the other hand, Betz cells can often be followed through the whole vertical diameter of the lobule, one of the largest forms being sometimes situated not far from the lip of the calloso-marginal fissure, while giant cells of but slightly smaller size continue into its depths. In this portion of the paracentral therefore we should expect to find motor excitability extend from its upper to its lower boundary.

The occurrence occasionally of giant cells outside of the motor cortex has been mentioned. Such cells are denominated the ganglionic cells of Bevan Lewis. Their presence shows that centralization has not yet become complete. The characteristic abundance of giant cells in the gyrus hippocampus indicates not only the close association between sensory and motor function, but gives evidence as well of the associated development and early intimate union between the phenomena of olfaction and movement, so important in the lower animals.

RÉSUMÉ.—The motor cortex occupies the middle region of the hemispheres, intermediate between the general and special sensory areas on the one side and the specific association or psychic center on the other. This zone is the earliest to functionate and the central sulcus forms to give increased room for its developing elements. It has been defined by the brilliant experimental work begun by Hitzig and Ferrier, by the clinical and pathological findings of Broca, Hughlings Jackson, and a legion of subsequent observers, by the intricate myelogenetic method of Flechsig, and by the histologic studies of Betz, Hammarberg and Cajal. Beginning with the observation of Hitzig that the motor area embraced nearly a half of the brain surface, its confines have have gradually become narrowed. It has long been assumed roughly to include both central convolutions and the paracentral. Beevor and Horsley cast a suspicion upon the motor function of the postcentral gyrus. Flechsig discovered embryologic differences which he believed justified him in considering the postcentral the seat of general incoming sensory impulses, and the adjoining precentral the seat of outgoing motor impulses. Finally, Cajal described a specific fibre distribution in the precentral convolution which he believes serves to differentiate it as the motor type of cortex.

That a motor type of cortex exists is abundantly proved. It is characterized by its unusual width dependent upon the marked development of the medium-sized pyramidal cell layer containing the specific plexus of Cajal, by the absence of a clearly defined granular zone, and by the presence of giant cells in the sixth layer with thicker and denser radial bundles and a richer development of the overlying tangential fibres which are of maximum density in those portions of the convolution which contain the greatest number of giant cells, both being more conspicuous in the fissure in the lower half of the Rolandic zone, and on the summit of the convolution in the upper part of the motor region. Passing beyond the limits of the motor area, superiorly, inferiorly, anteriorly, or posteriorly, one observes a gradual change in the cortical type, the third layer becoming narrower, the fifth wider, and the specific elements of the sixth disappearing. This change is typically illustrated in a cross section through anterior and posterior central convolutions. The paracentral presents both types of cortex, the transition taking place below the extremity of the fissure of Rolando although no surface marking determines the boundary.

My especial thanks are due to Dr. E. N. Brush and Dr. Stewart Paton for their kindly advice and criticism, to Dr. Wm. Rush Dunton, Jr., for supplying a number of facts which otherwise I should have missed, and to Miss Rebecca Moore for her able preparation of the histologic material.

A CASE OF METASTATIC ADRENAL TUMORS IN THE LEFT MIDFRONTAL AND ASCENDING FRONTAL CONVOLUTIONS.[1]

By WALTER CHANNING, M. D., and WALLACE M. KNOWLTON, M. D., Brookline, Mass.

A. B., American, male, age 48 years, single. On October 12, 1901, Dr. A. T. Cabot, of Boston, performed nephrectomy for the removal of a tumor involving the left kidney. Dr. W. F. Whitney, of the Harvard University Medical Department, reported to Dr. Cabot as follows on the tumor: "The tumor from the region of the kidney, was a mass weighing 940 grams and measuring 19 by 11 by 7 cms., in general its shape being that of a kidney. The surface was roughened and marked by numerous irregularly rounded elevations, some of them of a deep ochre and reddish color.

On section, the kidney substance was found to be largely replaced by nodules of new growth, in places discrete, in others more or less confluent, the general color of which was a deep ochre yellow, in many places with reddish centres, giving to the whole an extremely variegated appearance. These nodules were interpersed with areas of grayish, rather translucent kidney tissue. In some nodules the centres had become softened, and were replaced by cysts, and when near the surface with very thin walls. Projecting into some of the calices were small rounded nodules of the same new growth, and to some of these a large somewhat irregularly elongated thrombus-like mass was attached, filling the pelvis and extending to the commencement of the ureter. From the orifice of one of the cut renal veins there projected a reddish-gray thrombus composed of the same material.

[1] Presented at the annual meeting of the American Medico-Psychological Association, June 17, 18, 19 and 20, 1902.

Microscopic examination showed the kidney structure between the nodules fibrous with markedly injected vessels and distorted tubules, the epithelium of which was largely desquamated. The tumor itself was composed of large fat cells with conspicuous vesicular nuclei, seeming to stand in closest relation to the vascular spaces from the walls of which they apparently originated. These cells were further separated into little clumps by what appeared to be a fine connective tissue meshwork radiating also from the vascular wall. Everywhere there was rapid tendency to disintegration and degeneration, the products of which were mixed with hæmorrhage.

Diagnosis.—Sarcoma (perithelioma), of adrenal origin with invasion into the pelvis and veins."

Patient had been in poor health for about a year and a half. Had several attacks of hematuria. After the operation he improved very much, and was preparing to go away for the winter, when he was taken on December 9, with severe epileptiform convulsions.

He remained in a stupid state 24 to 36 hours. It was thought at this time that the convulsions were due to uremia. The urine was examined and found to contain a normal amount of urea. There was no headache or paralysis, nor mental symptoms.

Dec. 21, he had a second attack of convulsions which were more severe than the first and he came out of it slower. Since the second attack his power of attention was markedly weakened. He also kept tapping on the head of the bed continually, and showed other mental symptoms.

Jan. 8, 1902, slight symptoms of paresis appeared, more especially marked on right side of face with droop to the right eyelid, and symptoms of aphasia appeared.

Jan. 15, on admission he is quiet in manner, speaks pleasantly but with considerable hesitation and often uses the wrong word to express his meaning, which he seems to realize at times, and will try to correct himself; usually without success. He walks fairly well though he does not seem strong. The hand grasp is nearly equal on both sides; both somewhat weakened, perhaps slightly more so on the right. Pupils considerably contracted and respond to light, but less quickly to accommodation.

The tongue is somewhat coated and the tip is turned toward the left a little. The right side of the face is smoother than the left and has less expression. The left eyebrow is raised more than the right. He stands quite still on both feet with the eyes closed, but it is rather difficult for him to stand on either foot. Knee jerks are quite active especially on the right, but not on the left. Plantar reflexes mild. No Babinsky sign. Could not obtain reflexes at the elbow, perhaps because could not get patient to relax enough. He recognizes knife, pencil and coin in the right hand with the eyes closed, although it was two or three minutes before he named the knife. Heart and lungs normal.

He seems to recognize and appreciate ordinary sounds and noises. Obeys very promptly requests to show the teeth, protrude the tongue, close the eyes, etc. He apparently comprehends all that is said to him. Made an exact copy of "5 + 5 = 10" except that he crossed the sign of equality, and in reading, read "five plus five equals fifteen." Spontaneous speech is impaired as he substitutes the wrong word sometimes. In reading from the newspaper aloud he miscalls words occasionally and does not correct himself; often passes to the line below while half way across the column. Seems to recognize common objects. In writing his hand is somewhat unsteady and he duplicates letters, as in writing "sight" he wrote "sisight." Occasionally repeats a whole word while writing, but will correct his mistake sometimes. Requires several minutes to read a simple sentence. He will study over it as if trying to solve a problem. In trying to carry on a conversation he seems to realize when he uses the wrong word to express his meaning, and appears depressed in consequence of it, and will struggle to find the right word. Recognizes people and his surroundings.

Jan. 21, it is noticed that he does not stand quite as steadily as he did at last record.

Jan. 28, this morning about 12 o'clock he suddenly started to go up stairs and in attempting to do so nearly fell, his right arm and leg seeming almost helpless.

Jan. 29, was quite depressed at breakfast because he found he could not use his right hand very much in the attempt to feed himself. Seemed a little dizzy about 12 o'clock. Reads his

paper every day and generally takes a drive in the afternoon. Occasionally sends for some of his friends to see him; at other times he is depressed and does not apparently wish to see any visitors.

Feb. 3, he has lost strength in the right leg and arm, which are almost helpless. General sensation does not seem to be affected and pain sensation is retained as nearly as can be determined. He objects to continued examination, but when asked to write took pencil in left hand and after making a few marks on the paper, gave it up. On request made an effort to read aloud from the newspaper but did not pronounce intelligibly, with the exception of one-syllabled words. Was requested to read louder but did not make an effort to do so, Made no effort to talk except when addressed. It was impossible for him to express himself clearly, except in answering yes and no.

Was asked if he would like to drive; after a moment's pause, said, "I—er—don't—know." A key was put in his hand with his eyes closed. After a moment's hesitation he named it correctly. All his replies are delayed several seconds. He appears to be seeking for the right word. After beginning a sentence with "I—er," stops with an expression of disgust, and gives it up. Occasionally will express a want or an idea in a short sentence of simple words correctly.

Feb. 4, in bed and very weak all day. Could raise up in bed with an effort, using his left hand in doing so. Asked nurse if she would bring his wife. He apparently recognized the mistake but could not correct it. Later asked nurse if she knew how much a cord of wood would cost; then said, "I don't mean that." All of this was said brokenly and occupied several minutes. Seemed distressed because he could not say what he wanted to.

Feb. 5, still in bed. Got out of bed alone once but settled down on the floor as he could not stand on his right leg. When asked one time if he wanted anything, replied distinctly, "No, I don't." At one time said, "My goodness gracious, it is too bad." Is not inclined to talk. Smiles faintly when satisfied; scowls when expressing dissatisfaction. When asked, says he has no pain, and shows no evidence of physical suffering.

Rather more difficulty in articulating labials, and some consonants are not pronounced with any distinctness.

Feb. 8, right side is almost entirely helpless. In the evening was asked if the paper had been read to him; after a minute said, "yes"; when asked about the evening news said, "Well"—and then stopped.

Feb. 10, impossible to make accurate tests of his condition as at times he answers as if he did not understand. When asked a question would look up, but with a blank expression as if he did not hear, but a light pin prick at various points on both arms or legs would cause him to make a movement and bring a scowl to his face, although he did not appear to hear the question when asked if he felt it. There is considerable twitching of both limbs, also the arms, but the movement is more marked on the right side. Occasionally the right arm becomes quite rigid in tonic spasm which lasts about one minute and then passes away partially. The left leg seems to be uncomfortable.

Feb. 14, unable to turn in bed. Mind is not so clear and appears to be sleeping most of the time. Breathes with mouth open.

Feb. 15, was very dull during the morning. Nurse found it difficult to open his mouth sufficiently to give him nourishment. Choked occasionally while taking it. Respiration somewhat irregular. Pulse varies from 60 to 100.

Feb. 16, takes food at times from feeding cup, but at other times from the spoon. Often it is necessary to close his mouth after giving nourishment and ask him to swallow it, or he will hold it in his mouth. Will occasionally say yes or no to a question, but usually appears not to heed what is said. It is with difficulty that he moves his head on the pillow; neck appears to be quite stiff when head is raised from the pillow. Respiration quite heavy when he sleeps. Expiration longer than inspiration during the evening.

Feb. 17, soils and wets the bed. Makes no effort to speak. Occasional twitching of the arms and legs, especially on the right side. Right arm often becomes very rigid. Pulse in the morning and evening, 108 to 120, respiration 26.

Feb. 18, seems somewhat clearer. Appears to take more notice of what is going on in the room. Opened his mouth some

of the time without being asked while he was fed. Sleeps most of the time. Will make an effort occasionally to answer a question, but does not succeed.

Feb. 19, head and back of neck appear to be uncomfortable, apparently causing him some pain when head and shoulders are moved.

Feb. 20, this morning turned from his back to his side without assistance. Spoke a few words in a whisper or a very low tone of voice. Said to nurse, "I am going away—soon—soon—soon." Pulse 100 in the morning, 124 in the evening. Respiration 22-26, temperature 99.4° in the evening.

Feb. 21, several friends called to see him and he apparently recognized them, but would drop off in a stupor while they were in the room. Said good-by very distinctly to some of his friends when they left him, the only words spoken during the day. Pulse varied from 93 to 106, temperature in axilla 97.10° to 98.4°, respiration 19.

Feb. 22, could not say good-morning and did not put out his tongue when asked to, but when the doctor showed his own tongue patient immediately tried to follow the example, opening the mouth slightly and pushing the tongue forward as far as the teeth, but he could not protrude it. About 3.30 p. m. nurse noticed a marked change in his breathing. After whiskey was given pulse became stronger, and it was then noted as being 135 to 140 a minute. Temperature rose to 101°, and at 6.30 pulse was 160, respiration 40. During the rest of the afternoon and evening liquid food and water was occasionally given, a few spoonfuls at a time, by his mouth being opened and the liquid put into the mouth, which was then swallowed without much conscious effort. In the early morning it was noticed that his left foot and ankle was slightly swollen and covered with numerous small purpuric spots. By evening the whole leg was somewhat swollen and covered with these spots.

He was apparently semiconscious up to 9 o'clock in the evening. Respiration gradually increased in rate; it became shorter and more labored. At 10 p. m., pulse which had been scarcely perceptible at the wrist for several hours, was wholly lost, and the fibrillary twitching in the left hand and arm disappeared. From this time he began to sink more rapidly and finally passed away quietly at 2.30 a. m. the following morning.

The following is the report of the autopsy by Dr. F. B. Mallory, Associate Professor of Pathology, Harvard University Medical Department. Body of medium size, rather slenderly built, poorly nourished. Rigor mortis slight. Moderate swelling of left lower extremity. Numerous petechiæ in the skin of the swollen extremity extending almost up to the groin.

Brain (Plate XXI), Dura tense; convolutions could be made out through it. On removing the dura the convolutions were found much flattened, the veins of the pia moderately injected. After the removal of the brain from the skull, there was found in the left temporal region a slightly projecting tumor 2.5 cm. in greatest diameter. It was gray and translucent in appearance as though the surface was quite edematous. The convolutions surrounding it were much swollen.

The brain was carefully hardened in formaldehyde for two weeks and then a series of frontal sections were made through it.

The tumor (Plate XXII), measured 2.5 cm. It was situated 6 cm. from the longitudinal fissure, 6 cm. posterior to the anterior tip of the frontal lobe, and 5 cm. above the base of the brain. So far as could be determined without stripping off the pia it was situated in the posterior, inferior part of the swollen midfrontal (Gray's Anat.) lobe, just anterior to the precentral fissure and 4.5 cm. above the beginning of the fissure of Sylvius.

On section the tumor extended 3 cm. into the brain tissue. It was in part cystic, partly of a yellow opaque color, evidently due to necrosis. The growth was nearly circular, slightly lobulated, and rather sharply defined.

There was a second smaller tumor (Plate XXIII), in the ascending frontal lobe between the precentral fissure and the fissure of Rolando. It measured 8 mm. in diameter, and was situated 5 mm. below the surface, and lay 2 cm. above and posterior to the larger nodule. On section it appeared grayish and granular with minute yellowish specks in it. The white matter of the temporal lobe was swollen, edematous, and of a yellowish rather translucent appearance.

The median line of the brain anteriorly (third ventricle and surrounding structures), was pressed over to the right side about 1 cm.

A partial examination of the body was made through a small incision in the abdominal wall. Left kidney absent. Right kidney removed; appeared normal in size and color. Apparently no compensatory hypertrophy; weight 155 gms.

Except for old adhesions the abdominal cavity appeared normal.

Liver and spleen palpated; appeared perfectly normal to the touch.

The diaphragm was incised and both lungs were examined over their whole extent. In the lower lobe of the right lung near the lower outer border were found four or five nodules. These were removed. The largest measured 3.5 cm. in greatest diameter. It was of a grayish appearance dotted with irregular yellowish areas; the edges of the nodules were sharply defined. The tissue was not very dense. In the lower border of the left lung two similar nodules not over 1 cm. in diameter were found.

Microscopically the larger nodule in the brain shows tumor tissue only at the periphery. Elsewhere nothing is to be seen but necrotic tissue, blood, and large areas of fibrin and of finely granular material. In the smaller nodule the tumor is all well preserved.

The structure of the tumor in the metastases of the lungs and in the brain is similar. It is composed of large cells embedded in the meshes of a rather delicate connective tissue stroma, i. e. the structure is like that of carcinoma. Tre cells are of large size and epithelioid in character and the protoplasm presents a delicate reticulated appearance.

This case has been thought worthy of recording on account of the character of the tumors and of other unusual features that will be briefly mentioned.

Anatomical Diagnosis.

Hypernephroma, or carcinoma of adrenal origin. Absence of the left kidney. Scar of laparotomy wound in abdominal wall.

We were able to find on record only one case of tumor of the brain of a similar origin. This case of which a full report is given by Jores was one of sarcoma of both supra-renal capsules with metastasis to the brain.[1]

Moore reports a case in which tumors of the supra-renal capsules were said to be secondary to a sarcoma of the brain.[3]

The International Text-book of Surgery in describing Adrenal Tumors says, "The species of this genus are very remarkable tumors and until our knowledge of them is more extensive and precise it will be judicious to let them rank among sarcomata."[4] In a personal letter Dr. Mallory states that "Pathologists are not agreed whether tumors of adrenal origin should be called sarcoma or carcinoma. Hypernephroma, a term recently introduced obviates the use of either."

Supernumerary suprarenal capsules are sometimes found in the vicinity of the kidneys or at little distance, e. g., in the broad ligament. Occasionally strayed germs of the suprarenal capsule containing more or less fat give rise to small tumors in the substance of the kidney or just beneath the capsule.[5] It is of interest to observe that Virchow considers the medullary part of the suprarenal capsule as allied to nerve tissue.[5]

The absence of vomiting and of headache were noticeable features of the case, but during the last week or ten days of life the back of the neck was quite stiff and somewhat painful when the head was moved. Oppenheim[6] regards rigidity of the back of the neck with cerebellar ataxia as characteristic of tumor of the frontal lobe. The eyes were not examined either before or after admission, but there was no apparent disturbance of vision. Several writers have observed, however, that choked disc—which is an important symptom of brain tumor—does not always impair the sight even in a somewhat advanced stage.

It will be noticed that the stereognostic sense was not affected. This fact is mentioned as having a possible bearing in a negative way, on the question of astereognosis, by seeming to show that a cortical lesion in the areas occupied by these growths does not produce this symptom. Mettler[7] considers that while in itself astereognosis does not promise much as a very definite localizing symptom, in conjunction with other symptoms it may be of great value.

This brings us to the special reason for reporting the case to this association—the interest of the alienist in the subject of brain tumors on account of the mental symptoms which nearly always accompany them, and which sometimes obscure the physical signs to such an extent as to cause errors in diagnosis.

J. S. Russell[9] observes that cerebral tumors that cause mental symptoms may be unattended by the more usual diagnostic phenomena so that such patients are sent to asylums where the real nature of their malady is unsuspected until the end is approaching, or is only revealed on autopsy. He believes that fewer of these cases will go so long unrecognized when the ophthalmoscope comes to be more habitually employed in asylums.

It is quite generally accepted that mental symptoms are more constant in tumors of the frontal lobes. Gowers[9] says that in cases where there is more pronounced mental disturbance—hallucinations, delusions, or actual dementia in some cases simulating simple insanity, the tumor is generally in the anterior portion of the frontal lobe or in the temporo-sphenoidal lobe.

Oppenheim[10] is of the opinion that in those cases in which mental defect, apathy, stupor, or some well defined psychosis has constituted a striking symptom of the disease the suspicion of a frontal tumor may be entertained, but he does not consider this as yet a safe guide in focal diagnosis.

The Journal of Mental Science for January, 1902, contains a paper by Dr. P. W. MacDonald[11] in which he states that there are two theories held regarding the localization of the mind; one that the frontal or prefrontal lobes are concerned with the highest mental operations—the other that the occipital lobes are the seat of the intellectual faculties.

In support of the latter theory the "Hand Book of Physiology" is quoted as asserting that "experimental physiology lends no support to the view that the frontal brain is the seat of the intellectual faculties."

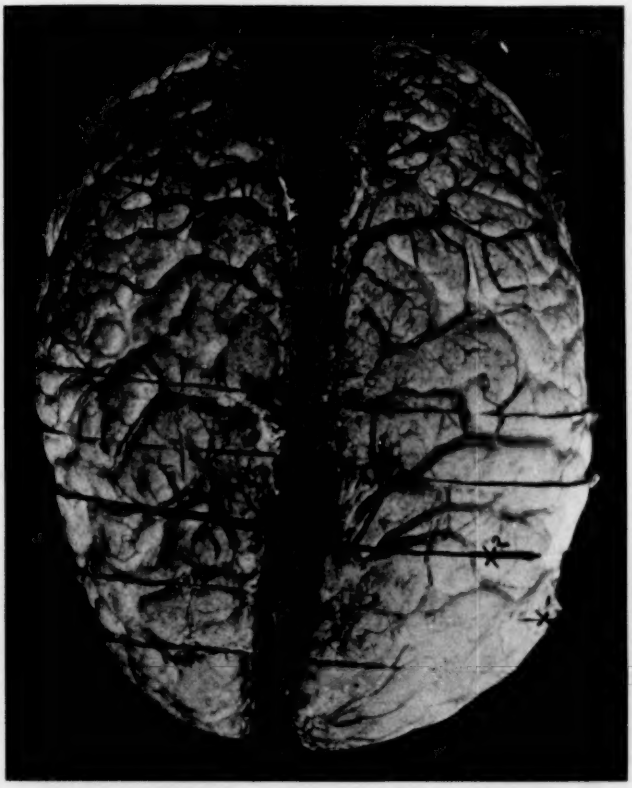
Reference is made to an article by Dr. C. Clapham[12] who after reviewing this question believes that "the evidence scales heavily in favor of the superior intellectual value of the posterior lobes." Other writers (Retzius, Carpenter, Bastian, Hughlings-Jackson, Flechsig), are mentioned as supporting this view of the subject, the latter observing that "the height of the forehead depends on the size of the sensation sphere and this in its turn upon the size of the body—thus the height of the forehead is no direct measure of the mental powers; the most important part of the brain for great mental powers seems to lie in the posterior regions."

As a result of the study of the post-mortem examination of the brains of forty-one idiots and imbeciles out of which number only three showed abnormality or defective development of the occipital lobes Dr. MacDonald agrees with the large majority of observers that the prefrontal region is the seat of the finer reasoning processes.

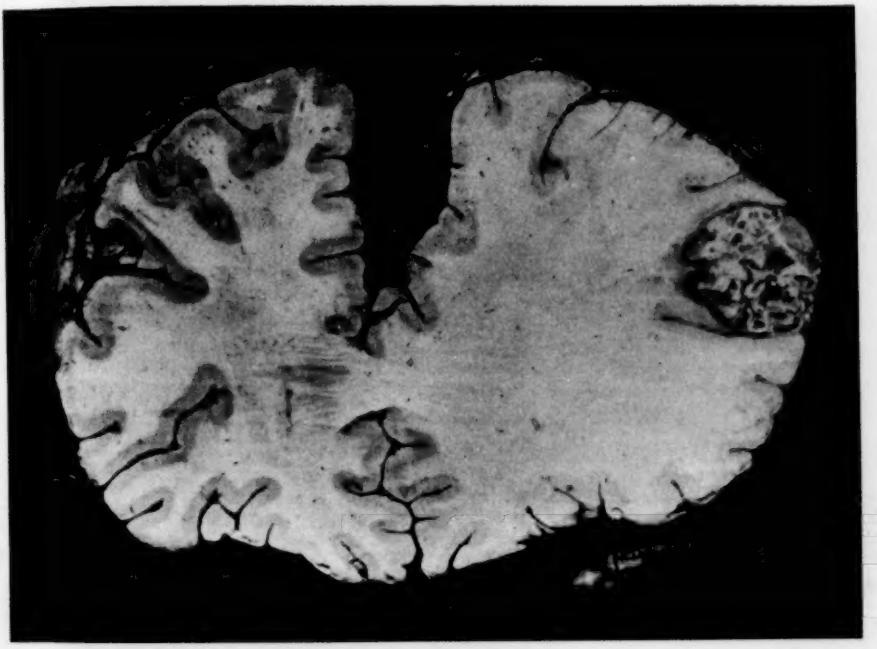
In this case aside from a moderate amount of apathy and depression the mind was quite clear, which would seem to corroborate the general opinion that while the motor and sensory regions must subserve mental operations the highest order of mental processes are presided over by those areas of the cortex that have no known motor or sensory functions.

BIBLIOGRAPHY.

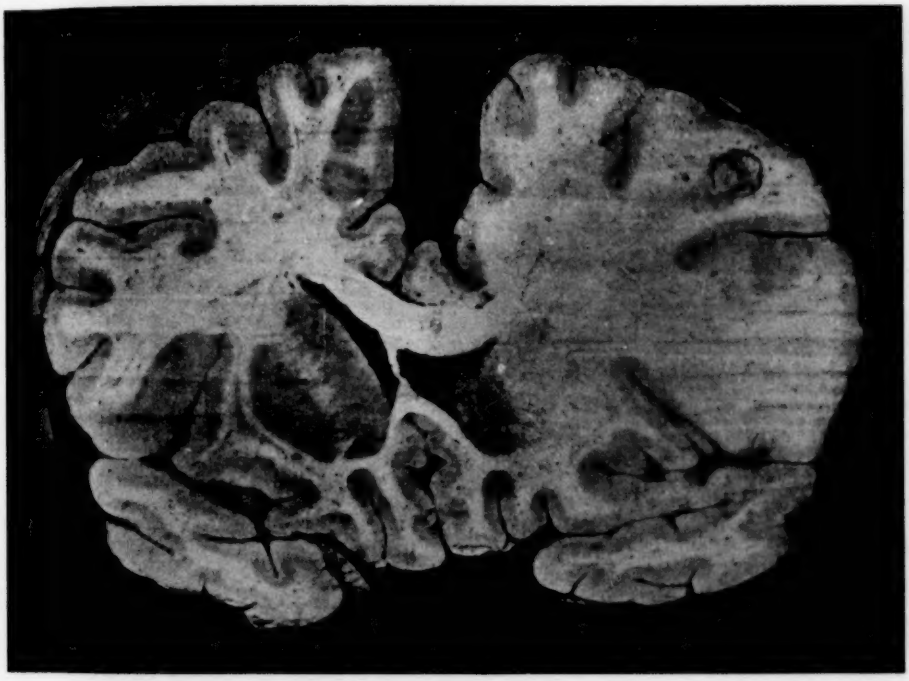
1. Deutsch. Med. Wochenschrift, 1894. Band 20, No. 9, p. 208.
2. Twentieth Cent. Prac. Med., vol ii, p. 28.
3. Tillman's Text-book of Surgery, vol. 3, p. 256-258.
4. International Text-book of Surgery, vol. 1, p. 479.
5. Ashurst's Internat. Encyclop. Surg., vol. v, p. 686.
6. Oppenheim's Dis. Nerv. System, 2nd Ed.
7. Mettler: Med. Record, Nov. 9, 1901.
8. J. S. Russell: Encyclop. Medica, 1899.
9. Gowers: Dis. Nerv. System, 2nd Ed., vol. 2, p. 507.
10. Twentieth Cent. Prac. Med., vol. 10, p. 321-322.
11. Journal Mental Science, Jan., 1902.
12. Journal Mental Science, April, 1898.



X^1 and X^2 indicate the location of the tumors.



Transverse section through the posterior and inferior part of the mid-frontal lobe. Front view showing larger tumor.



Transverse section through ascending frontal convolution. Front view showing smaller tumor.

Notes and Comment

RECEPTION HOSPITALS IN CITIES.—The annexed letter of Dr. Frederick Peterson to the *Buffalo Medical Journal* for November, 1902, deserves much more attention than it has yet received. The scheme of a reception hospital in every aggregation of population has long been urged by those who are familiar with the good work of the Bellevue Pavilion. It seems much more practicable than the erection of wards for the prolonged treatment of insane patients in connection with general hospitals. The reception pavilion is not a stopping place, but rather a gathering one from which patients can be examined and ultimately sent for treatment to the institution for the insane, to the general hospital or to the home, wherever in fact they can best be cared for.

Editor Buffalo Medical Journal:—I have your letter of October 11 requesting my views as to the need of psychopathic hospitals in the larger cities, and especially as to the expediency of establishing one in Buffalo.

In the first place I assume that all would agree that the sooner a case of insanity, especially an acute one, is put under the best treatment and safest supervision, the better. With this idea in view, a sort of emergency hospital, known as the psychopathic hospital, has been constructed in a great number of the chief towns in Germany. In many cities, both in this country and Europe, provision has often been made for these emergency cases in connection with general hospitals. Such has been the case for instance in Berlin, Vienna, in Paris, at the Bellevue Hospital in New York and in Philadelphia.

When I was resident physician of the Buffalo General Hospital there was then no asylum in your city and we received emergency cases of insanity at the general hospital, although we had no special provision for them. The methods of commitment are rather slow in this State, and hence many cases of insanity in which treatment should be begun at once have, pending their ex-

amination and commitment by legal process, been incarcerated in jails, station houses, or almshouses for some days without treatment. Where the State Asylum is located in the city limits as at Buffalo and Rochester, the need for a psychopathic hospital is not so apparent as in places like Syracuse and Albany, which are remote from any State hospital. At the same time I have been informed that even in Buffalo, patients are not infrequently kept in station houses awaiting the necessary legal examination and commitment. It is a fact that patients are sometimes sent to hospitals for the insane who are not really insane, but suffering from various forms of delirium due to typhoid fever, pneumonia and other diseases.

I would say that Albany has already established a reception pavilion in connection with the Albany General Hospital, where all these emergency cases of insanity and cases of apparent insanity are now received. This has proved very successful. If there were such a pavilion in connection with some general hospital in Buffalo, these cases could be received and treated immediately, pending their examination and commitment, and in cases which are doubtful their insanity verified before resorting to the legal process.

Let me call your attention to the statistics of the pavilion for the insane at Bellevue Hospital for the five months ending June 30, 1902. There were admitted 986 patients. Of these 652 were sent to the Manhattan State Hospital; 21 to private asylums for the insane; 33 to other institutions; 79 were sent into Bellevue Hospital as not insane, but suffering from other ailments; 182 were sent back to their friends without commitment; 27 died; 24 remained in the pavilion. What I would especially call your attention to here is the remarkable fact that out of this total number of 986 admitted, 79 were sent into the Bellevue Hospital as not insane, and 182 were sent back to their friends; 27 were so ill that they died in the reception hospital. In their classification of diseases received at the pavilion for the insane for three months ending June 30, 1902, there were 584 cases. Among these were 118 cases of epilepsy, hysteria, chorea, alcoholism, morphinism, and the like, and 28 cases marked as not insane. These statistics afford something of a commentary upon the usefulness of such a reception hospital.

When in Buffalo not long ago, I noticed that the newspapers were agitated as to the proper disposition of alcoholic patients who seem by the accounts given to be delirious but not insane and are sent to the penitentiary for treatment. While I admit that the need for a psychopathic hospital in Buffalo, owing to the presence of a large State hospital in your city limits, is not so pressing as in other cities, still I believe that there is a place for a reception pavilion of the kind indicated in connection with some one of your hospitals in the central part of the city.

FREDERICK PETERSON.

THE CARE OF THE INSANE IN GENERAL HOSPITALS.—In a recent paper by Clouston of Morningside before the British Medico-Psychological Association, published in the *Journal of Mental Science* for October, a strong plea is made for attempting to treat cases of acute insanity in general hospitals. The paper is marked by the author's well-known acuteness and mental grasp. He argues that in a general hospital the patient can often be treated without the loss of social prestige or business standing. If this is attempted successfully, mental disease is put on the same footing as other bodily diseases and the public mind becomes educated to regard insanity in the same light as any other severe and prolonged bodily affection. To treat these cases in general hospitals is simply to extend that specialization in medicine which has already done so much for the growth of medical science. To provide for them in general hospitals need be no more expensive than to furnish similar accommodation for surgical patients, cases of typhoid fever or severe cases of neurasthenia. No structural changes of an expensive character are required, nor would the presence of insane patients in a general hospital prove any more disturbing than the presence of patients delirious from Bright's disease or alcoholism. They should without doubt be treated separately from cases of ordinary disease and only those who are presumably in an acute and curable stage of insanity should be admitted. The general hospital should not be made a receptacle for cases of chronic insanity any more than it should be for other chronic diseases. Patients should be admitted precisely like other hospital cases and without any tedious legal formalities. A special staff of physicians and nurses should be provided in wards espe-

cially built to meet the needs of these patients. A time limit for their retention should also be fixed to prevent the accumulation of chronic patients. He concludes with an outline of what he considers an ideal provision for the treatment of the dependent insane. This would consist of: First, wards in connection with general hospitals for the reception of incipient, transient and proper cases of acute disease; second, reception hospitals for patients requiring a legal commitment; third, ordinary hospitals for insane patients which run on from month to month, and finally, a boarding-out system for quiet, industrious and manageable cases.

EXTRACTS FROM THE THIRTEENTH ANNUAL REPORT OF THE NEW YORK STATE COMMISSION IN LUNACY.—As the last report of the New York Lunacy Commission contains much material which is of great interest to all concerned in the care of the insane we present the annexed somewhat lengthy extracts as indicative of the plans of the Commission in future enlargements of the institutions of that State. The Commissioners say:—With the enlargement of the Rochester and Gowanda Hospitals during the coming year, these institutions will have attained the size of most of their sister hospitals and the Commission as required by the statute will be obliged in order "to prevent overcrowding in the State hospitals" to "recommend to the Legislature the establishment of other State hospitals." The question at once presents itself: Shall the policy of erecting large congregate buildings be followed or shall those designed upon the cottage plan be recommended. At the present time Germany approaches nearest to an ideal standard of provision for the insane, and this may be expressed in the following formula:

Small Hospitals for the Acutely Insane in Cities and Colonies for the Chronic or Mixed Classes of Insane in the Adjacent Country.—The hospital for the acute insane should be located as general hospitals are, in the most populous portion of the city, to afford convenient access from every quarter. It should have an outdoor department or dispensary, where mental cases may be seen in the very earliest stages. It should have its staff of internes and its attending or consulting physicians and surgeons, a well-equipped laboratory and auditorium for teaching, and opportunities should be given for the professors in medical schools in the

city to utilize the hospital material for the instruction of students and physicians in the still neglected specialty of psychiatry. Patients should be received for diagnosis as emergency cases without commitment papers, legal forms to be made use of only after a specified time has elapsed and when it becomes evident that long detention will be necessary. Such psychopathic hospitals are now organized in every university town in Germany.

The colony should be situated in the country, where out-of-door employment, so useful as a remedial measure for long-continued cases of insanity, can be provided. To the colony the reception hospital of the city may transfer the proper cases, convalescents, cases of slow progress, chronic cases, and incurables. The colony should be within easy access of the city, and on one or more lines of railway or waterway. It should be near enough for speedy and inexpensive transfer of patients, and near enough for the visits of friends. Economical reasons demand a situation to which coal and other expensive supplies can be brought at the least cost. Institutions have too often been located in out-of-the-way and inaccessible places. It would be difficult to estimate the exact annual cost to the people of some of the sites chosen, in the way of passenger tariff and price of delivery supplies. In some the saving that might have been effected by a better location would, it is safe to say, go far toward building a new institution every ten or fifteen years.

A cardinal fact that must never be forgotten in establishing an institution for the insane is that no matter where it may be situated, it will inevitably attract to it both acute and chronic cases. To the psychopathic reception hospital of the city, designed though it be for the special benefit of acute cases, will gravitate all the chronic insane that are free in the community. Not only will the colony in the country receive the overflow of the acute hospital of the town, but a large district whose radius will be measured only by railway facilities will send to the colony all kinds of insane patients, whether acute or chronic. This fact has been proved so often by experience that there can be no argument advanced against it. All asylums or hospitals for the insane become mixed asylums, and attempts to separate curable and incurable or acute and chronic cases are merely wasted efforts. The reception hospital of the city will naturally transfer at once such chronic cases

as are received by it. But the colony in the country must provide for the acutely insane who will surely be brought thither for care and treatment. In establishing a colony, therefore, after the selection of a proper site convenient to a railway or waterway, with abundance of land for agricultural and other industrial purposes, and with good water supply and sewage facilities, the first buildings to be constructed should be the administration building and a small hospital for the acutely insane. After these an infirmary should be built for all the infirm, sick, decrepit, idle and disturbed patients that are likely to accumulate in an institution intended for, say, 2000 patients.

A nucleus having been formed by the construction of these first necessary buildings, the various cottages which go to make up the true colony or farming hamlet may be added as required to complete the pre-arranged plan. It would be well that the whole of the land to be used for buildings should be properly laid out by a landscape architect, so that all the buildings to be erected shall have their sites determined in order to insure not only artistic harmony, but economy in the arrangement of roads, walks, water and sewer mains, and of the lines from the central lighting and heating plants. These cottages, which give the colony its village character and in which the workers reside, should be so disposed as to cluster about the various centres of industry—the farms and gardens, brickyard, quarry and shop. Skilful physicians and trained nurses and all the modern paraphernalia of medical practice will be needed in the acute hospital, and trained attendants and medical supervision to some extent in the infirmary. Two attendants, preferably a married couple, should suffice for the selected working class in each of the cottages, the woman to do the very simple cooking required, the man to be the supervisor and director of labor. The medical care here needed will be small. The larger part of the simple fare required will be prepared at the one central kitchen and bakery connected with the infirmary. The acute hospital should have a nurses' kitchen. Each cottage will have a kitchen range for minor cookery. The food ration should differ for every class. By such systematization and classification of patients, the cost of maintenance should be greatly reduced, especially in the items of food, medical officers and employees. The acute hospital and infirmary will be best made of fire-proof or

slow-burning construction. The cottages can be built as cheaply as desired. A pavilion for tuberculosis patients should be provided for occupation in winter only, tents being preferable in summer. This pavilion should be constructed of wood and ought to be destroyed in fifteen years, or it might be made a permanent structure of more durable material capable of thorough disinfection throughout the summer when unoccupied.

The colony system has been carried out in Germany and is much favored there. The arguments in favor of this system of care as opposed to the block system may be summarized briefly as follows: The original cost of the simple villa structures is less than that of the great blocks of buildings with their waste of space in corridors, their expensive under-ground tunnels, and their elaborate plumbing, heating and ventilating devices; furthermore, the annual cost for repairs is less.

The capacity of the colony may be readily increased at any time and to any extent without detriment to the original plan. It may begin with a simple cottage for twenty or thirty patients, and be enlarged year by year in accordance with the needs of a community.

The cost of the maintenance is certainly no greater in the one than in the other plan. The director of Alt Scherbitz, the most complete colony for the insane at present in existence, points out that the per capita cost of maintenance there is less than the average of other German asylums. An important feature is that sanitary conditions are better among scattered groups of patients than among large masses of human beings assembled together in one building.

The matter of food distribution from a central kitchen is shown by experience to be actually no more difficult or expensive by horse and wagon, carts or outdoor tram, than by trams laid in costly underground tunnels.

These are the arguments that will appeal to the taxpayer as reasonable and satisfactory.

A far more important line of argument in favor of the colony system is the one founded upon the welfare of patients, and the Commission feels that the taxpayers in general would be as much guided by what seems best for the insane as by the more practical questions of economy. They do not wish to see extravagance in

structure or maintenance, but neither do they desire to stint money where wise expenditure will conduce to better treatment and more humane care of the unfortunates they support.

The home idea is at the basis of the colony system of treatment. The huge general hospital of the cities for patients with sick *bodies* is the natural and legitimate result of the social conditions and the limitations of urban life. But the patient with the sick *mind* cannot, without diminishing his chances of recovery, be transferred from his home to the startling environment of most of our large asylum wards. One can imagine the effect upon the patient's already disordered imagination of finding himself locked into a corridor with barred windows and with from thirty to fifty noisy, violent, filthy and destructive patients about him, for in most of the large asylums thorough classification and segregation are impossible. The colony system permits of the most careful and complete classification in widely separate buildings of the acute, the sick and infirm, the homicidal and the suicidal, the noisy, the epileptic insane, the filthy and destructive, and the quiet chronic workers, instead of mingling them indiscriminately as is commonly necessary in the block system.

The individual must be more or less lost sight of in the congregate system, where a thousand patients often live together and may even eat together in one huge dining room. It has been well said that "the conditions in a large asylum are too abnormal, and the departure from all the conditions of ordinary domestic life are too abrupt and too vast to be conducive to real comfort and happiness." The attendants in the block system have their attention too much divided to be able to interest themselves in particular individuals, whereas in the smaller houses of the colony a greater intimacy and a more personal interest develop, and there arises as a result of such a system a generous rivalry between the various houses that is stimulating both to the attendants and to the patients.

We must not shut our eyes to the fact that all authorities agree that we accomplish more by moral agencies in the treatment of the insane than by the use of drugs. By moral agencies we mean appeals to the mind. Since it is chiefly through the mind that we must operate to restore balance to the faculties, surely it is of the highest importance to place the patient with mental disorder in the most suitable environment, one where there is the greatest indi-

vidualization, and the greatest stimulus to the disordered intelligence, an environment that is pleasant and homelike, and in which the associations shall be orderly, friendly, and familiar. In fact the patient's surroundings should be made as nearly normal as possible. An essentially abnormal environment cannot but be detrimental to an abnormal mind. Those who are interested in the colony system of care should make themselves familiar with the scheme of the Craig Colony for Epileptics in New York, which could serve as readily for the insane as for epileptics. They should also read the report on Continental colonies for the insane just published by the Lancashire (England) asylums board which is contemplating the erection of a sixth asylum in Lancashire on the colony plan.

The State should therefore construct reception hospitals for the acutely insane in the cities and colonies for the mixed classes of insane in the country. No State government should at this time undertake a system of care of the insane without careful consideration of this twentieth century method.

What the State has Accomplished in Recent Years for the Welfare of the Insane.—The Commission would be remiss in its duty if it failed to fully inform the Legislature, the friends of patients in the State hospitals and the taxpayers in the State of the efforts systematically and strenuously made year after year not only to bring about an enhanced recovery rate but to add to the physical well-being of such patients as suffer from bodily ailments tending to affect even remotely their mental restoration.

Probably very few persons outside of circles brought into immediate relation to the State hospitals know of the great number of improvements which have of late years been made in the methods of care of the insane.

1. A dentist is regularly employed at each of the hospitals to care for the patients' teeth and a dental office and apparatus have been provided for this purpose.

2. An oculist is a salaried attending officer at each hospital for the purpose of looking closely after the eyes and ears of the inmates.

These two features undoubtedly afford much relief to patients, as regard pain, indigestion and the ills which come from neglected eye and ear disorders.

3. Each hospital is fully equipped with an operating room quite equal to any in the general hospitals of our cities, where operations formerly altogether neglected are now almost daily performed. These operations often lead to the cure of insanity, a tumor or other lesion having acted as the physical cause of a mental disorder. It would be impossible to give even a brief summary of the notable operations which have been carried out in our State hospitals within the brief space available, but they would quite equal in number and success the results at many of the general hospitals of our cities.

4. A woman physician in every hospital ministers to the special needs of women in the way of operative and other treatment.

5. Some of the State hospitals for the insane situated in the cities have availed themselves of the services of distinguished specialists practicing in the community as consultants who have given their valuable time free of charge to the poor unfortunates confined in the asylums. In this way large numbers of patients have had, in addition to the care of the medical officers of the institution, the aid of expert surgeons, general practitioners, gynecologists and neurologists.

6. The training schools for nurses referred to elsewhere are now a part of the organization of every one of the State hospitals, so that all of the sick, the infirm and the operative cases have the same skilled care that they would obtain in general hospitals, while the entire standard of nursing the insane has been enormously improved and elevated by this means.

7. Patients were brought formerly by their friends, or more often by deputy sheriffs or other county officers, to the hospitals, frequently bound and tied and often in bad condition from unskilful management. Now nurses and if necessary a doctor are sent to the counties for the patients.

8. Restraint by means of straps, camisoles, strait-jackets, cribs, etc., the so-called "mechanical restraint," has been practically abandoned throughout the State for some years. In this connection we might mention that in the Wisconsin system of county care such restraint is still used.

9. The open-door system (by which is meant unlocked doors for certain of the convalescent wards) has been in vogue in this State for many years.

10. Women nurses have been introduced on a considerable proportion of men's wards in the hospitals in this State. They are usually married women, the husbands taking part in the work as male nurses. This has tended to introduce a more homelike condition in the wards, and has been distinctly beneficial in improving the character of the nursing of the sick and infirm.

11. The proportion of able-bodied patients employed in the wards, shops, garden, grounds, barns and on the farm has been constantly increased from year to year, so that the actual labor performed by the patients has a distinct monetary value, difficult to compute, but undoubtedly of real importance in diminishing the cost of maintenance to the low figure now reached.

12. The so-called "moral treatment" of the insane, by which is really implied "mental treatment," and through which the disordered mind is vastly helped towards the goal of recovery, has been constantly improved and extended. The wards and rooms have been made homelike and attractive. Flowers, birds, libraries, games, musical instruments have been provided. Theatrical entertainments, schools, lectures, concerts, baseball fields, tennis courts, and everything of this nature that could help to "minister to a mind diseased, pluck from the memory a rooted sorrow," has been provided.

13. Religious services are regularly given, and chaplains and priests supplied by the State for the spiritual needs of the patients.

We have enumerated above a few of the features which have been developed in the methods of care and treatment of the insane in this State during the past few years. A large number of improvments might be cited if it were expedient to go into still greater detail. We might for instance describe the installation of all sorts of hydro-therapeutic apparatus in every hospital for the administration of curative baths and douches, the complete equipment of the several institutions with electro-therapeutic apparatus and appliances for invalids, the construction of solariums, etc. But enough has been stated to emphasize the distinction between the present State care and the old county system where none of the above described aids to care and treatment were in vogue. When it is remembered that $155 per year is the actual present expenditures to the State for each patient, and this includes not only food, fuel, lighting and housing, but all the above noted

ameliorations in care and treatment, we feel that the State may justly be proud of its success, its economy and its progress in the promotion of the welfare of its insane charges."

DIPHTHERIA BACILLI IN WELL PERSONS.—In July, 1900, a committee was appointed by the Massachusetts Association of Boards of Health to consider the proper method of controlling well persons infected with diphtheria bacilli so that they might not be a menace to the health of the public. The report of this committee is now made public and the following conclusions are formulated:

"1. It is impracticable to isolate well persons infected with diphtheria bacilli, if such persons have not, so far as known, been recently exposed to the disease. If it happens that such cases come to the knowledge of the health office, it would, however, be wise to give instructions in regard to caring for the secretions, thus placing a part of the responsibility upon the infected person himself.

2. It is not advisable as a matter of routine to isolate from the public all the well persons in infected families, schools and institutions.

It is advisable to keep the children in infected families away from day-school, Sunday-school and all public places, and that they should remain on their own premises if possible.

Wage-earners may usually be allowed to continue their work; but teachers, nurses, and others who are brought in close contact with children should not be allowed to do so. Milkmen should not be allowed to continue their business.

When it is proposed to remove a well person from an infected family, it is not advisable to make the removal if diphtheria bacilli are present.

In schools and institutions it is usually advisable, if the infection is not too wide-spread, to separate from the others all infected persons, sick or well.

When diphtheria appears in a community which has for some time been free from it, it is advisable to isolate all persons who have been brought in contact with the patient until it shall have been shown that they are free from diphtheria bacilli."

These recommendations are especially pertinent to those who

have to do with institutions for the insane, where the population has a degree of permanency and where a separation of the apparently well person for an indefinite period is obviously surrounded by difficulties.

THE TERMINATION OF A CASE OF FEIGNED INSANITY.—In our issue of April, 1902 Dr. Allison reported a case of feigned insanity in a prisoner convicted of the crime of murder. The subsequent history may be of some interest to our readers.

The case was taken to the Court of Appeals where the decision was against the prisoner. Executive clemency was afterwards asked for on the ground of insanity and the Governor appointed Dr. W. Mabon, of the St. Lawrence State Hospital and Dr. H. L. Palmer, of the Utica State Hospital commissioners to examine into and report not only as to the then mental condition of the prisoner, but also what his mental condition was at the time the murder was committed. The Commissioners made several prolonged examinations and the prisoner's appearance and actions while under examination were very similar to those reported by Dr. Allison. The testimony of the prison officials was conflicting. A number of the guards and officers, including the prison physician, being firmly of the belief that the man was a malingerer, while one of the chaplains and a few of the keepers believed that he was actually insane. The examination had not proceeded very far before it was apparent that the prisoner was feigning and he was then informed that his conduct and symptoms did not accord with any recognized form of mental disease. After some slight hesitation he threw aside his mask of stupidity and expressed his willingness to talk about the case, and assumed an entirely different attitude. On the third examination he stated that he had been at the house of the murdered man on the night of the murder as well as on the preceding night, to which he had taken a gallon of alcohol, part of which he and the murdered man consumed. He further stated that if he committed the crime it was done while he was under the influence of alcohol and that he had no recollection of it. He acknowledged that he had been shamming during his residence in the prison and that he feigned insanity at the time of the trial.

The prisoner was apparently of a low mental order and with

a very limited education and the question naturally arose as to whether or not he was an imbecile and therefore irresponsible for his acts. The Commissioners reviewed all the testimony in the case as found in a printed report covering over eight hundred pages and after weighing all the facts obtained at their examination and giving due value to the testimony, requested the Governor for additional time, so that they might visit the community in which the prisoner formerly lived and where the murder was committed in order to try to establish the truth or falsity of his statements and also to obtain the opinions of his immediate neighbors touching his reputation and any mental peculiarities which he might have exhibited prior to the murder. The request for more time was granted and the Commissioners again visited the prison and made another examination of the murderer, when he talked freely of his case but contradicted some of his former statements. On this visit the keepers who were seen reported that he had changed in many respects and no longer attempted to act the part of a demented man. The Commissioners visited the community in which the prisoner formerly lived but were unable after examining a large number of witnesses to learn that the man had ever manifested sufficient evidence to even warrant a suspicion that he was mentally deficient. On the other hand most of the witnesses testified that his reputation was bad, that he had formerly been convicted of a crime, that he had been suspected of several crimes in the community, that his word was not to be relied upon, that he was looked upon as a man of considerable shrewdness and that he was regarded by all who knew him to be a temperate man. It was impossible to substantiate his statement that he had purchased from a drug store the alcohol which he claimed that he and the murdered man had drunk.

Altogether over three weeks' time was given to the consideration of this case; the Commissioners reported to the Governor that the prisoner was not insane at the time of their examination, that he was not insane at the time of the murder, nor was he at any time, so far as they could learn, irresponsible, but on the other hand, although a man of low mental organization and without education, he knew the nature and quality of his act and should be held accountable for the crime.

On the strength of this report the Governor refused to commute the sentence and the prisoner was electrocuted on the 18th day of November, 1902.

NEW SUPERINTENDENT OF BELLEVUE HOSPITAL.—Dr. William Mabon, formerly Superintendent of the St. Lawrence State Hospital, Ogdensburg, N. Y., became Departmental Superintendent of Bellevue and the Allied Hospitals on New Year's day, in succession to Dr. George T. Stewart, resigned. This appointment promises much for the future of those institutions and will be hailed with satisfaction by all who are familiar with the success of Dr. Mabon's administrative work elsewhere. The new Superintendent is a native of New Brunswick, N. J., where his late father was a Professor at Rutgers College. Dr. Mabon graduated at the Bellevue Hospital Medical College in 1881. After filling a position on the House Staff of the Charity Hospital, Jersey City, he entered general practice for a season until, in the autumn of 1885, he was appointed assistant physician to the State Asylum for Insane at Morris Plains, N. J. In 1887 he became assistant physician at the Utica State Hospital under the superintendency of Dr. G. A. Blumer. In 1895 he was appointed Superintendent of the Willard State Hospital and after little over a year's service at that institution, he was called to take charge of the St. Lawrence State Hospital at Ogdensburg where he has served continuously since.

It was seen that Dr. Mabon brings to his new field a rich experience in hospital management. He will find in it a wide scope for executive energy, since his office includes not only Bellevue but Fordham, Harlem and Gouverneur Hospitals. We understand that in addition to administrative work in that department, Dr. Mabon will perform the duties of consulting physician to the Pavilion for the Insane attached to Bellevue Hospital—an important and active service. We are pleased to note moreover, that his appointment has been taken out of politics. Formerly the position of Superintendent was controlled by the Commission of Charities. Now it is safeguarded by being vested in a non-political and non-sectarian Board of Trustees. For some time there have been rumors of a new Bellevue and we are inclined to think that Dr. Mabon would hardly have been

allured from the magnificent structure on the banks of the St. Lawrence to the old hospital on which he has just laid a firm and guiding hand had he not had some assurance that before very long old Bellevue would be razed to the ground to make way for the best hospital in New York City. We are very much mistaken in our estimate of the man if he will rest content with anything short of this. Already tenders are invited for building a new Harlem Hospital, the estimated cost of which, aside from the price of land, will be, when completed, about $500,000. The JOURNAL congratulates the Board of Trustees on having secured the services of Dr. Mabon at a critical juncture in the history of Bellevue Hospital and bespeaks for him a cordial encouragement in the herculean work of reorganization that awaits his competent and willing service.

DUAL MANAGEMENT OF HOSPITALS.—Men who are wont to drink freely of the heady wine of new ideas in hospital management are apt to mistake the resulting feeling of exhilaration for the inspiration of truth. It is oftentimes difficult, when the habit is confirmed, to make the appeal from Philip drunk to Philip sober, for, after all, the mental condition engendered is akin to one of inebriety. But we know of no better corrective in this very matter than a perusal of the back files of this JOURNAL. The practice is distinctly sobering. The lesson has been brought home to the present writer by a consideration of what has been said during the past year or two anent psychopathic hospitals. It is surprising how a new word carries us off our feet and how slowly we regather strength to stand and look at things in their proper relations. Mercier, in his recent Textbook of Insanity, appreciates this human foible in his sly reference to "toxins" as "a very comforting word, which enables us to believe that we know far more about the causation of insanity than we did when we ignorantly called them poisons." Similarly, there are some of us who think we are far in advance of our brethren when we talk glibly, without knowing exactly what it implies, of psychopathic hospitals. Conservative men realize that sudden departure from an established order of things often spells misfortune, for they know that all steady advance is a matter of slow evolution. And those who have lived long enough

have perhaps made the discovery that under our new, umbrageous and "comforting" word there lies an idea that is by no means new.

We are moved to make these remarks not in any spirit of cynicism, for we welcome any propaganda that has for its object the thorough hospitalization of institutions for the insane. The task suggests itself rather as a duty in view of a side issue. It was natural, after all, that persons unfamiliar with the history of psychiatry in this country should have reasoned that, under the new dispensation that is coming, the medical superintendent of a hospital for the insane should be shorn of some of his executive functions, using the specious plea that his whole energies should be devoted to the strictly scientific aspects of his work, but forgetting that that much-abused word "scientific" has a wider range of meaning than the bedside and the laboratory prescribe. So here and there history is repeating itself in the suggestion that dual management is a corollary of the psychopathic hospital. Alas we had flattered ourselves that that ghost was laid years ago. To us it is so self-evident that in order to secure the best administration there shall be no conflict, no separateness nor even concurrence of authority, that it seems almost puerile to argue the question. That argument was admirably stated, over sixty years ago, by Dr. James MacDonald formerly superintendent of the Bloomingdale Asylum, in a letter proposing a plan for organizing the New York State Lunatic Asylum, addressed to the President of the Board of Trustees.[1]

A paragraph or two is worth quoting:

"As the supreme object of the institution, to which everything in its construction and government directly or indirectly tends, is the improvement and recovery of the insane; I propose that the physician in chief, who may also have the title of Director, shall be its first officer, the head, in name and in fact, of the whole establishment, so that all other officers, under the board of trustees, shall be subordinate. The physician and director should be the mainspring of the whole machine, the master spirit of the entire institution. As he is to exercise such high functions and to originate and direct the treatment, medical, moral, physical and dietetic of a thousand insane minds, he should be held responsible for the results, at the same time that he should be invested

[1] Report of Trustees of the State Lunatic Asylum, with the documents accompanying the same, pursuant to the Act of the Legislature passed May 26, 1841. Am. Jour. of Insanity, October, 1865.

with sufficient authority for the execution of his plans. He should have power to hire or dismiss all subordinate persons in the employ of the institution; and all superior officers should be so far under his control as to receive instructions from him."

"The adoption of this part of the plan will prevent a division of interests, and keep one part of the household from arraying itself against the other, and if properly used will make everything tend to one point, the comfort and restoration of the insane. If it confer upon one individual increased authority, it imposes additional obligations. His direct responsibility for the welfare of the institution and the conduct of its other officers must check any abuse of power."

"I would not say more on this subject, if it had not been the practice in some asylums to place the physician on a footing with and even subordinate to other officers. Happily, however, this anomaly is vanishing before the progress of sound principles, but to sustain the position here laid down, I beg leave to quote the highest authorities of Europe. Pinel, one of the most illustrious names of France, in medicine and philanthropy, says: "Whatever may be the principles on which an asylum is conducted, whatever modification it may receive from time, locality, and different forms of government, the physician, by the nature of his studies, the extent of his knowledge, and the strong interest which he has in the success of treatment must be so well informed as to be the natural judge of everything that passes in a hospital for the insane." Jacobi, the experienced and distinguished physician of the large asylum at Sieburg, in Germany, says: "As every operation in this department, also (that of steward) must concur with the rest in promoting the ultimate object of the establishment, and as the most perfect unity of purpose and unimpeded activity must everywhere characterize all the exertions made to this end, so it is here again evident that the supreme direction and control of all the officers and servants without exception employed in this department, must likewise be concentrated in the directing physician." Esquirol, the highest authority of the age in which he lived, says: "The physician should in some manner be the vital principle of an insane asylum; it is by him that everything must be put in motion; called as he is to be the regulator of all thoughts, he directs all actions. Everything which interests the inmates of the establishment points to him as the centre of action. The physician should be invested with an authority from which no person can escape."

The necessity that authority shall be single and supreme in such establishments is emphasized in the same article[1] by the following quotation from a report by that eminent alienist, Dr. Henri Falret, speaking for French hospitals:

"Everything which concerns the insane being intimately connected, all the measures which the administration may take being of a nature

[1] Physician in Chief of an Asylum. Am. Jour. of Insanity, Oct., 1865.

to influence the morals of the patients, all the circumstances by which they are surrounded constituting an essential part of the moral treatment, there can not be, in an establishment for them, without serious inconvenience, any other authority than that of the physician.

Thus, in leaving to the minister of the interior the right of separating the administrative and medical powers, and of appointing the superintendents and the physicians; the law of 1838, otherwise, taken as a whole, so eminently useful, has, in this respect, been very injurious to asylums for the insane.

Notwithstanding the evil consequences of this separation of power, which has become a source of continued conflict and struggle, the authority has none the less persevered in separating that which admits of no separation, and even lately, we have noticed the appointment of a superintendent over the establishment of Fains, where, hitherto, the two powers had been united in the hands of the physician. It is with a great deal of pain, that we have seen in a recent decree, which threatens to be so fatal to asylums, that the government not only endorses anew this principle, but even assigns an inferior situation to the physician, in leaving to the prefect the power of appointing him, and reserving all rights to the superintendent.

If all those employed, without exception, are not under the control of the physician in all that concerns the establishment, there can be no unity of purpose, and without unity, it is impossible to establish a durable and beneficial organization; if the persons employed are not convinced of the supreme authority of the physician, if they recognize a rival or superior power, their concurrence will be weak and vacillating, their conduct ever wrong, the order of the establishment constantly compromised; and in the midst of this division of power, the insane will want the direction and advice so indispensable to them, and will find means of evading the prescriptions of the physicians or the different regulations, instead of refraining from their propensities, and exercising a salutary control over themselves.

We have only to examine what takes place in French asylums, where the physician is not the superintendent, to be convinced of the necessity of uniting all power in the hands of a superintending physician; the nature of things, still more than individual character, gives rise to continual conflicts and quarrels between the physician and the superintendent, which terminate ordinarily in the removal of one or the other, the same trouble soon to recur with similar results.

In Germany the two powers are united in the physician, the happy effects of which are continually visible. Why should it not be the same in France? Why should some asylums still have a superintendent and a physician, while others have already a superintending physician?

It is asserted that if the duties of the principal physician and superintendent are united in the same person, the superintendents are liable to be inferior, or the physicians but little versed in the theory or practice of their art. It is also said that this system may be applicable to small, but would not be for large establishments, because too great an amount of labor would be intrusted to one individual. All these objections are

not serious; if one can not be at the same time a good administrator and a good physician, why should the direction of some asylums be entrusted to physicians?

To be consistent, then, it would be necessary to suppress completely superintending physicians. But how do the Germans manage, who have at the head of their establishments physicians so distinguished as Roller, Jacobi, Damerow, Flemming, etc., who are at the same time excellent superintendents?

As to the extent of work, it is easy to remedy this, by giving to the chief physician subordinate auxiliaries; unity of direction is thus left to him, and the difficulty of having his commands executed, removed."

If more recent testimony be desired, let us quote, in conclusion, from a paper on Hospital Organization[3] by Dr. George H. M. Rowe, superintendent of the Boston City Hospital presented at the Annual Meeting of the National Association of Hospital Superintendents at Philadelphia, October 14, 1902. That its sentiments emanate from Boston entitle the pronouncement to especial consideration.

"Experience has made me a believer in what is called the military plan of household government. Twenty years or more ago, this régime was not in favor. Many a hospital and asylum has been rent in twain by the dual system, one man being nominally superintendent, and the other the steward.

With the trustees as the governing board, with the superintendent as their executive officer (in all matters outside the professional care of the sick), the departments should radiate in direct lines from the executive, in such a manner that no two subordinate officers or employees can conflict with each other, without the jurisdiction of the superintendent to settle the difficulty. This I consider a most important principle."

And in another place this experienced and philosophic superintendent says:

"Is not such a system illogical, unbusinesslike, conducive to friction, shifting the various responsibilities, subversive of the best discipline, and tending to disrupt the household family? Sometimes the result is "open war" unless, perchance, the two heads of two branches of one organization possess the souls of saints and the forbearance of Job. The unal arrangement conduces to harmony, unity of action and control, as the two departments cannot avoid coming into contact and overlapping their lines of duty."

Whoso is wise will ponder these things.

[3] Observations on Hospital Organization. By George H. M. Rowe, M. D. Printed for private circulation by S. J. Parkhill & Co., Boston, U. S. A.

Abstracts and Extracts

PARADOXICAL PSEUDO-HYPERTROPHY FOLLOWING INFANTILE CEREBRAL HEMIPLEGIA. By L. Pierce Clark, M. D. Journal of Nervous and Mental Disease, Vol. XXIX, No. 11, Nov., 1902.

This report is the author's second paper upon the rare phenomenon of hypertrophy occurring in the infantile cerebral palsies. He has reported in all five of the twelve cases upon record. After a review of the literature the author proceeds to an analysis of all cases in which the hypertrophy occurs. The family history, intra-uterine life, birth, sex, and causes leading to the stroke, throw no light upon the occurrence of the condition. All cases recorded prior to these in this paper developed in subjects of athetosis and the hypertrophy was present in the parts most agitated; but in four of his own the author found no athetosis but a partial epilepsy of the post-hemiplegic type instead. The enlargement in some of the previously reported cases involved all parts that were paralyzed; even the breast, testicles and face of the side involved showed hypertrophy. The skin, fat and muscles may all hypertrophy in a single case, although some muscle hypertrophy is present in every case. The hypertrophy has been in the upper extremity in all cases but one. The order for the increase of size of these parts is: the arm in nine cases; the forearm in two; the calf in one. The particular muscles undergoing hypertrophy in order of their greatest involvement are: Biceps, deltoid and triceps. The parts not hypertrophic follow the general rule of atrophy in such lesions. In two of the author's cases true fibre hypertrophy existed; an enlargement and increase of the muscle spindles were found. Usually hypertrophy and hyperplasia went hand in hand. In all cases the hypertrophy was found of the pseudo variety. The hypertrophic parts were found invariably weaker than those of the sound side. Bony hypertrophy was present in the author's, in Lannois' and Foyalle's cases. Occasionally the bones of the entire upper extremity may hypertrophy, although usually those underlying the enlarged muscles increase in size. The degree of circumferential enlargement varies from ¼ to ⅞ inches, although not usually more than ½ an inch. The author believes that the condition must obtain under the following conditions: "The lesion is cortical, slight and transient; the integrity of the elements remains more or less intact and a post-hemiplegic disorder of motility such as athetosis or a focal epilepsy, by agitation of the paralyzed parts, causes the hypertrophy." The article is accompanied by excellent photographs showing the states of hypertrophy.

THE CRIMINAL RESPONSIBILITY OF THE EPILEPTIC.

In an article with the above title read by Dr. Punton, of Kansas City, before the Mississippi Valley Medical Association and published in a

recent number of the Medical Record, the author's conclusions are as follows:

1. That epilepsy is a symptom of brain disease.

2. That its continued presence tends toward mental degeneration.

3. That the mental responsibility of the epileptic depends upon the extent to which the mind or self-control of the individual has been impaired by his epilepsy.

4. That the legal test of insanity is not sufficient, because a state of mental irresponsibility is not incompatible with a knowledge of right and wrong.

5. That epileptics to some degree at least are responsible for their own acts, more especially when their epilepsy is due to their own default.

6. That the criminal acts of epileptics appeal to medical knowledge rather than to the law for the proper adjudication.

7. That in all cases of murder where epilepsy has been proven, the law should be amended to allow commitment to an insane hospital rather than to a penitentiary.

8. That the question of the mental responsibility of an epileptic should be referred to a medical commission appointed by a court, which may in turn call upon local or county societies to name the members of the commission.

PARALYSIE GENERALE JUVENILE, par L. Marchand, M. D., et Ch. Leuridan, M. D. L'Echo Médical du Nord, An. VI, p. 349, juillet 27, 1902.

Cases of juvenile general paralysis have become numerous. At first regarded as idiots, imbeciles, or precocious dements, it has been found that these individuals always suffer from a diffuse meningo-encephalitis. The case reported was that of a laborer, the illegitimate son of a vicious father. He had always been of a sober disposition. The symptoms began when the patient was 18 years of age, and consisted of convulsive attacks, a dimming of the mental faculties, and a marked physical weakness. He was admitted to the hospital when he was 22 years old. His face was expressionless, there was a coarse tremor of the hands, speech was monotonous and hesitating; there was inequality of the pupils, and the patient was untidy. The knee-jerks and pupillary reflexes were normal, and sensibility seemed well preserved. The intellectual weakness and the motor changes were marked. Six months after admission the patient died in an advanced state of cachexia. Weakness and emaciation were very marked; the knee-jerks and the pupillary reflexes were abolished, and he was in a state of complete dementia. The autopsy showed a few granulations in the lateral ventricles, a milky appearance of the pia, and an atrophy in the motor regions. Microscopic sections disclosed an increase in the neuroglia, especially in the molecular layer, cell degeneration, and a marked diminution of the tangential fibres. The vessels and meninges showed inflammatory changes. W. R. D.

DEMENTIA PARALYTICA BEI EINEM EHEPAAR. DIE PARALYSIE BEI DER FRAU EINE PERIODISCHE PSYCHOSE KOMPLICIREND. By Dr. Herman Lund-

borg. Psychiatrisch-Neurologische Wochenschrift, Bd. IV, p. 301, October 4, 1902.

The husband was not observed by the author, but from his history had evidently suffered from tabo-paresis, of which he had died at 40 years of age. The wife was admitted to the hospital at Upsala when 53 years old, with a history of having had several attacks of periodic mania. She had had numerous epileptiform attacks before her admission and these continued. She showed the physical and mental symptoms of paresis but had periods of excitement. The author concludes with references to similar reported cases. W. R. D.

PARALYSIE GENERALE ET TRAUMATISME CRANIEN AVEC CORPS ETRANGER. By Dr. Gimbal. Revue de Psychiatrie, t. XIII, p. 421. Septembre, 1902.

The case detailed is that of a wine-broker with quite a prolonged history of alcoholism and bad heredity, who, after a quarrel with his mistress, shot himself in the head. There was loss of consciousness for one hour, and hemorrhage from the ears persisted for two days. It was not deemed necessary to extract the bullet and the patient left the hospital at the end of fifteen days. At the end of three weeks a loss of memory was noticed and soon after it was necessary to place him in the asylum at Villejuif. He had most of the physical signs of paresis. The author considers that traumatism was not the only factor in the paresis, but was a combined cause with alcoholism and heredity. He concludes with a résumé of the opinions of other authors who agree with him. W. R. D.

SINDROME PARALITICA GENERALE PER CISTICERCOSI DEL CERVELLO. By. C. Ferrarini and G. Paoli. Giornale di Psichiatria Clinica e Tecnica Manicomiale, Anno XXX, p. 276, Apr.-Sept., 1902.

The writer gives a detailed report of a case of paresis with the results of the autopsy, the most striking finding being numerous cysts upon the surface of the brain, due to the presence of the cysticercus. Reference is made to several articles of a similar nature in the literature. W. R. D.

OBSERVATION DE PARALYSIE GENERALE GEMELLAIRE HOMOMORPHE (DELIRE DES NEGATIONS). By P. Keraval and G. Raviart. Archives de Neurologie, t. XIII, p. 370, Mai, 1902.

Twin brothers of unknown antecedent history had become affected with paresis, the one at 39 years, the other at 47. The first was markedly negativistic and died after being 8 months under care. The second was also negativistic in the beginning, and both cases showed the physical signs of paresis. The duration of the disease in the second case was three years. It is of interest that the type was so similar in the two cases, their ideas of negation being similarly expressed, even the same phrases being used. W. R. D.

DES LESIONS VASCULAIRES DU CERVEAU DANS LA PARALYSIE GENERALE. By J. Havet. Bulletin de L'Academie Royale de Medicine de Belgique, t. XVI, p. 303.

The author has studied sections from 38 cases of different forms of mental alienation, for the purpose of confirming the views of Marshalko and Mahaim on the subject of the cerebral blood vessels. His conclusions are as follows:

1. The plasmic cells of Marshalko situated about the cerebral vessels of paretics do not seem to have the pathognomonic importance in the diagnosis of paresis which Vogt has attributed to them. Our cases show that these cells are found in mental diseases other than paresis, while on the other hand, it has been proved that these cells may be absent in undoubted cases of paresis.

2. The infiltration of lymphocytes into the perivascular sheath of the cerebral vessels of paretics has not the diagnostic importance which Mahaim attributes to it. This lesion may be observed in diseases other than paresis and the syphilitic psychoses, nor does it occur in every case of paresis.

3. In opposition to the opinion of Mahaim, lymphocyte infiltration of the perivascular sheath does not seem more frequent or more easy to recognize than the presence of the plasma cells of Marshalko.

4. There are around the vessels of certain paretics, numerous cells which possess a nucleus of irregular form and structure, and whose protoplasm is filled with a great number of vacuoles of large size, and also with large granules which stain intensely. W. R. D.

CINQ OBSERVATIONS DE PARALYSIE GENERALE CONJUGALE. By P. Keraval and G. Raviart. Archives de Neurologie, t. XIII, p. 487, Juin, 1902.

The authors report five cases in which paresis was observed in married couples. In four the husband was first attacked; in one, the wife. Syphilis and alcoholism were the principal etiological factors. W. R. D.

LA PARALYSIE GENERALE D'APRES LES DONNEES DE LA CLINIQUE PSYCHIATRIQUE DE L'UNIVERSITE DE MOSCOU. By Serge Soukhanoff and Pierre Gannouchkine. Archives de Neurologie, t. XIV, p. 193, Septembre, 1902.

The total number of patients treated was 3916, of whom 651 were paretics, 562 being men and 89 women. For convenience in study the term of twelve years, which has elapsed since the opening of the institution, is divided into three periods of four years each. It was found that the number of paretics treated had increased both relatively and absolutely, the number of women paretics especially in the last period. If the number of male and female insane were equal, the number of paretic men would be more than three times greater than the number of paretic women. For both sexes the age of onset was more frequent between 36 and 40 than at any other time, and was the same for the men, while for the women from 31 to 35 was the period of most frequent onset. Seventy-two per cent of the patients were married. Heredity of alcohol and nervous and mental diseases was quite marked. Of the men, 61.54 per cent had undoubtedly had syphilis. The time elapsing from the infection with syphilis to the appearance of the paresis varied from less than five years to over

twenty, 36.98 per cent occurring from 6 to 10 years after the lesion. The demented form was most frequent both in men and women. The knee-jerks were exaggerated and the pupils were unequal in a majority. The pupils reacted in but 20 per cent of the cases.

RECHERCHES EXPERIMENTALES SUR LA SENSIBILITE OLFACTIVE DANS LA PARALYSIE. By Toulouse and Vaschide. Revue de Psychiatrie, t. XII, p. 64, Février, 1902.

The same writers have published numerous other articles on the olfactory sense. In the present investigation the subjects were 28 women belonging to three periods of paresis. Dilutions of camphor water were used, commencing with the weakest and gradually increasing until the weakest was found which the subject recognized as an odor. This gave the minimum of sensation and ten similar trials gave the average for each subject. The minimum of perception was found in the same manner, determining the weakest solution of camphor recognized as camphor. The recognition of ten different odorous subjects gave another indication of the power of perception. A tube of distilled water was used as a control. The average minimum of sensation was 3 per 10,000 as compared with 1 per 100,000 in normal women. The average minimum of perception was 4 per 10 as compared with 5 per 100,000 in the normal. The number of patients who did not recognize any odor (anosmiques) was 8, about one-third, while in the normal it was one-thirteenth.

OBSERVATION DE TABES ET PARALYSIE GENERALE AVEC AUTOPSIE ET EXAMEN HISTOLOGIQUE. By J. B. Buvat, M. D. Revue de Psychiatrie, t. XII, p. 218, Mai, 1902.

The author reports in detail the history and pathologic findings in an old diabetic, syphilitic patient suffering from cephalic tabes with progressive blindness. There were hallucinations of taste and smell, and delusions of persecution, auto-accusation, euphoria, and delusions of grandeur, followed by paralytic dementia. W. R. D.

LE REFLEXE ACCOMMODATEUR ETUDIE CHEZ LES MEMES MALADES AUX TROIS PERIODES DE LA PARALYSIE GENERALE. By E. Marandon de Montyel, M. D. Revue de Psychiatrie, t. XII, p. 266, Juin, 1902.

The author's conclusions are as follows: 1. In paresis the accommodative reflex is more often abnormal than normal. 2. It is more apt to be diminished than exaggerated. 3. Its disappearance is more frequent than simple diminution. 4. In but 1.5 per cent the same condition was present in both eyes. Where it was not, it was normal in one eye and absent in the other. 5. Whether there is an exaggeration or diminution, that of moderate degree is most frequent of all the cases, the first occurring five times as often as the latter. 6. Only in the first period is the normal reflex more frequent than the abnormal. It is equal in the second and less in the third period, so that the abnormality increases with the progress of the disease. 7. The exaggeration especially and the changes in equality of

the two sides have been greater in the initial phases of the disease exclusively, whilst the disappearance is shown in direct ratio, and the weakness in inverse ratio to the progress of the disease. 8. The frequency of marked weakness has been in inverse ratio to the frequency of disappearance. 9. The accommodation was abnormal in more than one-third of the cases at the time of the remissions and it is only in the demential form that the abnormal is greater than the normal in a very marked proportion. For the other varieties expansive, depressive and mixed, the excess of the normal states over the abnormal was very small. 10. There is not one single mental form in which we have encountered all the special alterations and weakness is the only trouble observed in the five forms, even it was the only change in the depression and the remission, whilst the demential form has furnished the maximum of abolitions, and the exaggeration has been found most often in the expansive form. 11. Accommodation has been found most frequently and most profoundly changed in periods of excitement. 12. The reflex has always been abnormal in traumatic paresis; it comes after alcoholism. 13. Exaggeration of accommodation has not been observed with syphilis, while disappearance was always the trouble observed with traumatism and is shown in enormous proportion with the common causes, yet in alcoholism we have noted an equal number with weakness. 14. It is at extreme ages after 50 years and before 30, that accommodation has been most frequently altered and less frequently from 30 to 50 years, however at both the ages, the abnormal condition is greater than the normal and the influence exerted on the different forms of change was negative. 15. Accommodation has been found much more frequently and much more profoundly changed in the two first periods that motility was more attacked and it was only with the mild motor troubles that exaggeration was observed. 16. The reflex has been found much more frequently changed than the tactile sense, and the sense of cold (algesique) was equally affected; however, we have not found any relation between the various changes of the two sensibilities and those of accommodation. 17. The examination of the reflex of accommodation by its frequent and early changes may aid in the diagnosis of doubtful cases but is not believed to furnish any indication of the slow or rapid evolution of the chronic periencephalitis. W. R. D.

Treatment of Early Mental Cases in a General Hospital.—Springthorpe (Intercolonial Medical Journal of Australasia, April 20, 1902) makes a plea for provision for early and doubtful cases of alienation in observation wards or receiving houses; the separation of the curable in small wards or detached hospitals; and the fusion of hospitals and asylums, with the establishment at the latter of a constant medical, surgical and neuropathological staff. The author has treated some of his insane patients in the wards of the Melbourne Hospital and comes to the conclusion that early cases and mild forms of mental troubles can be taken care of in a much better manner in a general hospital than in the ordinary county or state asylums.

LOCALIZATION OF THE MENTAL FACULTIES IN THE LEFT PREFRONTAL LOBE.—Pheips (American Journal of the Medical Sciences, April and May, 1902) has studied three classes of cases illustrating the localization of mental faculties: 1, atrophies; 2, pistol-shot wounds; 3, abscesses and tumors. He has carefully collected all the literature possible on the subject, all reports of cases, and has analyzed them carefully. After excluding a number of cases for various reasons, he formulates the three following propositons which he holds to be justified by the cases which have been retained:

1. The more absolutely the lesion is limited to the left prefrontal lobe the more positive and distinctive are the symptoms of mental default.

2. The integrity of the mental faculties remains unimpaired in a lesion of the right frontal lobe, though it involves the destruction of the entire lobe, or even extends to the entire hemisphere.

3. The exceptional instances in which seemingly opposite conditions exist are always reconcilable, on more careful examination, with the assertion of an exclusive control of the mental faculties residing in the prefrontal region of the left side.

THERAPEUTIC VALUE OF WORK IN HYSTERIA AND NEURASTHENIA.—Schwab (Interstate Medical Journal, May, 1902) has collected a number of opinions on the value of occupation in hysteria and neurasthenia, nearly all of which are favorable. At the same time he quotes Erlenmeyer, who has published in the Berliner klinische Wochenschrift a paper dealing with the negative side of the question. The latter asserts that the work-cure is contra-indicated in (1) cases in which fatigue and exhaustion are prominent symptoms; (2) states of excitement; (3) cases in which psychopathic symptoms, such as melancholia, anxiousness, are prominent; (4) where the patient has always worked and can work, and in spite of this, the nervous symptoms exist; (5) cerebral or spinal diseases. The author concludes with an interesting case of his own of a patient with marked hysteria in which the work-cure was responsible for a marked improvement, if not a permanent cure.

the two sides have been greater in the initial phases of the disease exclusively, whilst the disappearance is shown in direct ratio, and the weakness in inverse ratio to the progress of the disease. 8. The frequency of marked weakness has been in inverse ratio to the frequency of disappearance. 9. The accommodation was abnormal in more than one-third of the cases at the time of the remissions and it is only in the demential form that the abnormal is greater than the normal in a very marked proportion. For the other varieties expansive, depressive and mixed, the excess of the normal states over the abnormal was very small. 10. There is not one single mental form in which we have encountered all the special alterations and weakness is the only trouble observed in the five forms, even it was the only change in the depression and the remission, whilst the dementiai form has furnished the maximum of abolitions, and the exaggeration has been found most often in the expansive form. 11. Accommodation has been found most frequently and most profoundly changed in periods of excitement. 12. The reflex has always been abnormal in traumatic paresis; it comes after alcoholism. 13. Exaggeration of accommodation has not been observed with syphilis, while disappearance was always the trouble observed with traumatism and is shown in enormous proportion with the common causes, yet in alcoholism we have noted an equal number with weakness. 14. It is at extreme ages after 50 years and before 30, that accommodation has been most frequently altered and less frequently from 30 to 50 years, however at both the ages, the abnormal condition is greater than the normal and the influence exerted on the different forms of change was negative. 15. Accommodation has been found much more frequently and much more profoundly changed in the two first periods that motility was more attacked and it was only with the mild motor troubles that exaggeration was observed. 16. The reflex has been found much more frequently changed than the tactile sense, and the sense of cold (algesique) was equally affected; however, we have not found any relation between the various changes of the two sensibilities and those of accommodation. 17. The examination of the reflex of accommodation by its frequent and early changes may aid in the diagnosis of doubtful cases but is not believed to furnish any indication of the slow or rapid evolution of the chronic periencephalitis. W. R. D.

Treatment of Early Mental Cases in a General Hospital.—Springthorpe (Intercolonial Medical Journal of Australasia, April 20, 1902) makes a plea for provision for early and doubtful cases of alienation in observation wards or receiving houses; the separation of the curable in small wards or detached hospitals; and the fusion of hospitals and asylums, with the establishment at the latter of a constant medical, surgical and neuropathological staff. The author has treated some of his insane patients in the wards of the Melbourne Hospital and comes to the conclusion that early cases and mild forms of mental troubles can be taken care of in a much better manner in a general hospital than in the ordinary county or state asylums.

LOCALIZATION OF THE MENTAL FACULTIES IN THE LEFT PREFRONTAL LOBE.—Phelps (American Journal of the Medical Sciences, April and May, 1902) has studied three classes of cases illustrating the localization of mental faculties: 1, atrophies; 2, pistol-shot wounds; 3, abscesses and tumors. He has carefully collected all the literature possible on the subject, all reports of cases, and has analyzed them carefully. After excluding a number of cases for various reasons, he formulates the three following propositons which he holds to be justified by the cases which have been retained:

1. The more absolutely the lesion is limited to the left prefrontal lobe the more positive and distinctive are the symptoms of mental default.

2. The integrity of the mental faculties remains unimpaired in a lesion of the right frontal lobe, though it involves the destruction of the entire lobe, or even extends to the entire hemisphere.

3. The exceptional instances in which seemingly opposite conditions exist are always reconcilable, on more careful examination, with the assertion of an exclusive control of the mental faculties residing in the prefrontal region of the left side.

THERAPEUTIC VALUE OF WORK IN HYSTERIA AND NEURASTHENIA.—Schwab (Interstate Medical Journal, May, 1902) has collected a number of opinions on the value of occupation in hysteria and neurasthenia, nearly all of which are favorable. At the same time he quotes Erlenmeyer, who has published in the Berliner klinische Wochenschrift a paper dealing with the negative side of the question. The latter asserts that the work-cure is contra-indicated in (1) cases in which fatigue and exhaustion are prominent symptoms; (2) states of excitement; (3) cases in which psychopathic symptoms, such as melancholia, anxiousness, are prominent; (4) where the patient has always worked and can work, and in spite of this, the nervous symptoms exist; (5) cerebral or spinal diseases. The author concludes with an interesting case of his own of a patient with marked hysteria in which the work-cure was responsible for a marked improvement, if not a permanent cure.

Book Reviews

Trattato di Psichiatria ad uso dei Medici e Degli studenti dei Prof. Bianchi Leonardo. Parte IIa. Napoli, 1902.

The second part of Prof. Bianchi's treatise includes pages 171 to 378 and contains chapters on the physio-pathology of perception, physio-pathology of attention, physio-pathology of memory, physio-pathology of ideation, physio-pathology of emotion, and sentiment, physio-pathology of volition, and conscience. It will be seen from these chapter headings that the second part of Bianchi's treatise deals with the psychological part of psychiatry. Like part one it further serves as an introduction to the third and last part, which is announced as on the press. Each chapter is really an epitome of its special subject. While the author is concise and clear, there are places where clearness would have been gained perhaps by briefer statements. There is little advanced which is new, but the author evidently had in mind the class of readers for which his book was intended, for whom new and untried theories would be out of place. On the whole the second part of the work is an excellent compend of psychology.

Nervous and Mental Diseases. By Archibald Church, M. D., Professor of Nervous and Mental Diseases and Head of Neurological Department, Northwestern University Medical School; and Frederick Peterson, M. D., Chief of Clinic, Department of Nervous and Mental Diseases, and Clinical Lecturer on Psychiatry, College of Physicians and Surgeons, New York. Third Edition, Revised and Enlarged. Octavo, 870 pages, with 322 illustrations. Philadelphia and London: W. B. Saunders and Co., 1901. Cloth, $5.00, net.

We know of no more useful treatise upon nervous and mental disorders in English, and we take pleasure in commending the thoroughly revised third edition to our readers. Alienists will doubtless be most interested in the portion of the book written by Peterson. The sections on cranial anomalies, deformities of the palate and anomalies of the ear are especially well-written and well-illustrated. The chapter on Paranoia and Idiocy are unusually comprehensive and satisfactory. The illustrations of the latter are extremely instructive. It is to be hoped that Dr. Peterson may be induced to give a monograph upon forms of mental disorder due to degeneration. Such a work is much needed in America.

Memoranda on Poisons. By. Thos. Hawkes Tanner, M. D., F. L. S. Ninth Revised Edition by Henry Leffmann, A. M., M. D. (Philadelphia: P. Blakiston's Son & Co., 1902.)

This little book is too well known to need more than passing comment.

The present edition has been thoroughly revised and the facts therein expressed are strictly in accord with what is taught at the present time. We know of no book on this subject that is more convenient for ready reference.

A Text-Book of Insanity. By Charles Mercier, M. B., M. R. C. P., F. R. C. S., Lecturer on Insanity at the Westminster Hospital Medical School and at the London Medical School for Women. London: Swan Sonnenschein & Co., Limited. New York: The Macmillan Company. 1902.

Before we took up this book we had not thought it possible to boil down the whole philosophy of insanity into the compass of but little over two hundred pages of a small octavo. Yet no lesser feat than this has been accomplished by this well-known and prolific author. It is a *tour de force*. What impresses the reader at the outset is a dominant note of originality both in thought and treatment, although not less impressive is the author's terse, clean-cut, virile English. The book is the outcome of Dr. Mercier's necessities as a teacher as well as of those of the students whom for years he has been teaching; and his belief that our knowledge of insanity has reached a point at which its various forms and varieties, like those of bodily diseases, can be described as typs, without discursiveness and bulky descriptiveness, is fully warranted by his performance. He also had it much at heart to emphasize the distinction between forms of insanity and varieties, a distinction which he thinks goes far to solve the difficulties of classification which have been the crux of authors and students for generations. The book is divided into three parts. Part I treats of The Institutes of Insanity, with chapters on (1) Conduct, (2) Mind, (3) Certifiability and Fitness to be at Large, (4) The Causes of Insanity.

Conduct being the main thing that is disordered in insanity, the many ways of its disorder are fully described in the opening chapter. "Conduct is the pursuit of ends." According to the author, the great and ultimate end to which all life is directed is the continuation of the race to which the individual belongs. "Life is not a gift but a trust, to be employed in transmitting life to a new generation; and, this purpose effected, the *raison d'être* of the individual is at an end." This proposition leads to a discussion of the reproductive function and its morbid aberrations. It is refreshing to note a thrust in this connection at certain lovers of the pornographic when, in speaking of perversion of the sexual passion, the author animadverts on the "lingering solicitude and minuteness of detail, out of all proportion to their importance," with which this subject has been treated. His treatment of the important class of cases in which the minor activities of social life alone exhibit disorder is luminous and must aid materially the practitioner—for whom the book is mainly intended—when diagnosis is not easy.

In the capter on "Mind" the whole subject of delusions is discussed as well as disorders of memory. There is sound advice in the chapter which treats of certifiability and fitness to be at large, with insistence upon

the fact that every patient with acute insanity is a potential suicide and a caution to neurologists to have a care in recommending their patients to travel, as they are "particularly fond" of doing.

The author is at his best in discussing the causes of insanity. Starting with the postulate that "Whenever a mechanism fails to perform the duty demanded of it, the reason must be either that the work is too heavy for the mechanism or that the mechanism is not strong enough for the work," he launches into a consideration of the interdependence of heredity and stress as the prime factors in the conspiracy of causation. Here plain language is used to bring home plain truths. No strange words of foreign importation obscure the idea. It is in this chapter that we find this playful gibe: "Nowadays masturbation as the prime and sole cause of insanity has been abandoned in favor of 'toxins,' a very comforting word, which enables us to believe that we know far more about the causation of insanity than we did when we ignorantly called them 'poisons.'"

Part II treats of "Forms and Varieties of Insanity." By a *form* of insanity the author here means a certain aggregate of symptoms presented at a given time by a given case; and by *variety*, a specific course that a case may run from beginning to end, usually combined with an assignable cause. In brief, a form corresponds to what is ordinarily called a symptom, while a variety corresponds to what is called a disease, exhibiting, as it may, different symptoms at different times or at the same time.

His forms of insanity are the following: a. Weakmindedness. b. Stupor. c. Depression. d. Excitement. e. Exaltation. f. Suspicion. g. Systematized delusion. h. Obsession and impulsiveness. k. Moral perversion. His varieties are: 1. Idiocy. 2. Dementia. 3. Stupor. 4. Acute delirious mania. 5. Acute insanity. 6. Fixed delusion. 7. Paranoia. 8. Folie circulaire. 9. Insanity of reproduction. 10. Insanity of times of life. 11. Insanity of alcohol. 12. General paralysis. 13. Insanity of epilepsy. 14. Insanity of bodily disease.

A critical consideration of these chapters would carry us too far, but it is interesting to note, among many other noteworthy features of this capital book, and as illustrating the difference between the attitude of Britain towards new things and that of the United States, that there is here no discussion of the doctrines of Kraepelin. Nevertheless, howsoever he may regret this absence at this time, the reader will probably find himself in sympathy with this highly individualized Englishman's point of view and be content to await the result of the impact of those doctrines on the conservative British mind when they shall have "arrived," in the French sense of that word, to disturb the *status* of things there as already it has been disturbed on this side of the Atlantic for the past year or two.

Des Tics en Général. Presented by M. LE DR. E. NOGUÈS, of Toulouse, at the twelfth session of the Congrès des Médecins Aliénistes et Neurologistes, Grenoble, August, 1902.

The subject is presented in a monograph of about one hundred and fifty pages.

The first of the nine chapters is a most admirable historical survey of tics from the time of the earliest use of the word, in 1702, to the present day.

The second chapter delineates tic and selects, from the chaos of spasmodic manifestations to which the name has been applied, the affections which may be properly grouped under that term. The author concludes with MM. Meige and Feindel that in the case of a motor reaction in which the cerebral cortex does not and never has taken part, it is not a tic; if that motor reaction is the consequence of pathological irritation at a point somewhere on the bulbo-spinal reflex axis, it is a spasm; in the case of a motor reaction of which the cerebral cortex takes or has taken a part, it is not a spasm; and if that motor phenomenon, where is recognized the participation at any time, of the cerebral cortex, displays certain distinct pathological characteristics, that is a tic. The name *tic douloureux de la face*, which has been given to trigeminal neuralgia, has contributed largely to the confusion of ideas.

The author thinks that certain frequently repeated gestures should be deprived of the name tic. He says that in the so-called mental phenomena of tics it is inconceivable to him how a tic could exist without motor phenomena.

He indicates that the general conception of the myoclonies has tended to introduce chaos in place of differentiation and that the use of the terms tonic and clonic tic has added to the confusion.

In chapter three the general characteristics of tic are further described with remarkable nicety and precision. It is said of them that they are voluntary, habitual, alternately conscious and unconscious, co-ordinated and systematic. Credit is given to Meige and Feindel for having exposed the relation which exists between tics and functional acts and having determined the mode in which the motor reaction of tic presents itself to the clinician. Tics, say these authors, could be considered as *motor perturbations of functional acts*. The vegetative, digestive and circulatory functions, not depending on volition, never exhibit tics. Professional cramps, spasms, neuroses and impotency are very carefully distinguished from tics in that they are produced only at the occasion of the functional act of which they are the anomaly. All the characteristics of the function are found in the disturbed function (the tic): repetition, premonitory necessity and satisfaction following its accomplishment. Tics are said to be always varieties of functional disturbance, but in the tic the character of the function is vitiated: the motor rhythm no longer obeys the law of least effort: the necessity becomes excessive, the act is produced inopportunely.

The fourth chapter is devoted to the symptomatology of tics, and many varieties are described. The ordinary practitioner will be surprised to find among these many of the habits of friends, acquaintances and patients which he perhaps had not previously regarded as tics.

In chapter five the mental state of those afflicted with tics is discussed. The author thinks, although the patients may be classed as degenerates, it is better to refer to them as mentally unbalanced. They often have intellectual powers of the first order though with unequal development of the other faculties. There is lack of volitional balance; there are sudden desires,

imperative caprices, excessive variability of ideas with no perseverance, extreme volitional debility. The attention is diminished by reason of the volitional debility; the affection is disordered; there are excessive sympathies and antipathies, veritable phobias and philies. The great analogy between tic and obsession with the frequency and intimacy of the relation between them is clearly indicated.

Since the introduction into psychology of the term "faculty" every variety of mental disturbance has been explained by the convenient phrase, "a lack of balance between the faculties," and with very little alteration the above characterization of the mental state of the sufferer from tic applies equally well to the mental state of the hysteric, the neurasthenic or even the maniac. It is, in fact, a general description of mental inferiority, and M. Noguès, though emphasizing this lack of balance, has avoided the common error of being satisfied with the alluring rotundity of the term and has more accurately and explicitly described the mental state of the patient.

In the sixth chapter the pathological physiology and pathogeny receive attention. Chapter seven discusses the etiological factors and the two final chapters are devoted to diagnosis, evolution, progress, duration, termination and prognosis.

A short time ago the reviewer found it necessary to investigate the literature of tic and discovered to his chagrin and perplexity that the whole subject was a labyrinth of terms. Myoclonies, tics, convulsions, choreas, hysterias and ataxias were found to be inextricably jumbled in nosological systems as numerous as the learned writers. Even the older and more standard authors exhibited either confusion or dissatisfying brevity. No one system was found satisfactory and the personal classification compounded for temporary use afforded no great gratification. Now it is to this crying need of order that M. Noguès has responded. With great modesty he takes no credit to himself, saying that he has but paraphrased the treatise of MM. Meige and Feindel, a work now in preparation and to which he attributes great scientific value. This modesty and the liberal use of quotation marks should not, however, tempt one to take M. Noguès at his word, for he has worked with delicacy and certainty of touch in the delineation of a clinical syndrome heretofore but a chaotic involvement. While he may not have evolved original theories, he has used his quotation marks with such care that we know what is and what is not a tic. Nowadays, when there is such an accumulation of mere verbiage on scientific subjects, the work of the sifter is often of even greater value than that of the builder. The main value of the work lies in the determination of the conditions which deserve the name of "tic" and in the careful description of these conditions. He has reviewed, systematized, and correlated the work of many authors, showing the points of agreement and disagreement. It is a reduction to terms of least common denominator. This is prettily exemplified in the discussion of the pathology, the author showing that the disagreement between MM. Brisaud and Grasset has arisen from the failure of each to appreciate the other's standpoint, one considering the origin of tic in time, the other its origin in space.

Both the psychiatrist and the neurologist will welcome this work as a large help in the study of motor reactions. W. McD.